VOLUME 10 NUMBER 3

AMERICAN JOURNAL

OF

DISEASES OF CHILDREN

EDITORIAL BOARD

FRANK SPOONER CHURCHILL, Chicago

L. EMMETT HOLT, New York City DAVID M. COWIE, Ann Arbor, Mich.

JOHN LOVETT MORSE, Boston EDWIN E. GRAHAM, Philadelphia

JOHN HOWLAND, Baltimore

SEPTEMBER, 1915

PUBLISHED BY
AMERICAN MEDICAL ASSOCIATION
CHICAGO, ILL.

ENTERED AS SECOND-CLASS MATTER, JANUARY 4, 1911, AT THE POST-OFFICE AT CHICAGO, ILLINOIS, UNDER ACT OF CONGRESS OF MARCH 3, 1879

CONTENTS OF VOLUME X

JULY, 1915. NUMBER 1

PAGE

Congenital Dextrocardia with Patent Interventricular Septum. With Fluoroscopic and Electrocardiographic Examination. Rudolph Duryea Moffett, M.D., and Selian Neuhof, M.D., New York.... 1

Pathology of Myatonia Congenita (Oppenheim). August Strauch, M.D., Chicago..... 16

A Case of Congenital Heart Disease with Demonstration of Specimen. John Lovett Morse, A.M., M.D., Boston..... 27

Acute Infective Endocarditis. Due to Streptococcus Attenuans in a Child One Year Old. Francis Huber, M.D., New York..... 33

Catarrhal Jaundice in Infancy. T. C. Hempelmann, M.D., St. Louis.. 39

Progress in Pediatrics: Review of the Literature on the Feeding and Gastrointestinal Diseases of Infants for the Year 1914-1915. Grace Meigs, M.D., Washington, D. C..... 42

Current Pediatric Literature..... 74

AUGUST, 1915. NUMBER 2

PAGE

Some Studies on Sugar in Infant Feeding. Langley Porter, M.D., San Francisco, and Charles Hunter Dunn, M.D., Boston..... 77

Pyloric Hypertrophy in New-Born Infants. F. L. Wachenheim, M.D., New York..... 87

Studies in Bronchial Glands. William W. Howell, M.D., Boston..... 90

Acute Nonepidemic Inflammation of the Sublingual Glands in Children: An Affection of Unknown Origin. Harold Neuhof, M.D., New York..... 94

A Protective Therapy for Mumps. Alfred F. Hess, M.D., New York.... 99

Parapharyngeal Abscess as Distinguished from Retropharyngeal and Peritonsillar Abscesses. Henry Heiman, M.D., New York..... 104

Progress in Pediatrics: Dysendocrinism in Children. Mark S. Reuben, M.D., New York..... 110

Current Pediatric Literature..... 148

American Journal of Diseases of Children

VOL. 10 SEPTEMBER, 1915 No. 3

THE PROTEIN NEED OF INFANTS

BEING METABOLISM STUDIES OF A TWO MONTHS' OLD INFANT FED WITH VARYING PROPORTIONS OF COW'S MILK PROTEIN *

B. RAYMOND HOOBLER, A.M., M.D.
DETROIT

The problem of determining the optimum quantity of protein necessary for the growing organism has been the subject of numerous observations. The result of feeding to an infant large quantities of protein over a prolonged period has not been studied to the extent it deserves and it was with a desire of increasing our knowledge on this subject that the work detailed in this paper was carried out.

It has been shown many times that the growing organism requires a certain quantity of protein for the replacement of tissues due to "wear and tear" as well as for growth of body, true growth being intimately associated with the retention and fixing of nitrogen compounds as integral parts of the body. No doubt the amount of protein required varies from time to time in accordance with what Mendel[1] has been pleased to call the "growth impulse." However variable may be the demands of this "growth impulse" for protein, it can never be as variable as the supply which is furnished, particularly in artificially fed children. When the baby is breast fed the protein intake is more constant, although it naturally will vary with the protein content of the milk, being highest in the first few days of lactation, quickly diminishing as colostrum changes to milk, and then remaining fairly constant to the end of lactation. Barring these variations the breast fed infant is subjected to much less disturbance in protein supply than the average artificially fed child.

The proportion of protein supplied in mother's milk should be a helpful criterion in determining the protein requirement. In his

---

* From the Physiological Laboratory of Cornell University Medical College, and the Pediatric Division of Bellevue Hospital, New York City.

* Read at a meeting of the American Pediatric Society held at Lakewood, N. J., May 24, 25 and 26, 1915.

1. Mendel: Trans. Fifteenth Internat. Cong. on Hyg. and Demog., Washington, 1913, ii, 429.

Harvey Society Lecture Howland[2] has stated this point clearly. He says:

> There is every reason to believe that the amount [of protein] furnished a healthy nursing infant represents at least a sufficient quantity and cannot be much in excess. However, since only 80 per cent. of the nitrogen of human milk is available (the other 20 per cent. being in the form of urea and extractives) one may, when feeding cow's milk, where practically all the nitrogen is available, reduce the quantity of protein to an amount equal to 80 per cent. of that supplied by mother's milk. Since about 8 per cent. of the total energy of mothers milk is supplied by protein, and since 20 per cent. of this energy is in a form which cannot be used, one may from this line of argument decide that 6.4 per cent. of the total energy of a food should be in the form of utilizable protein.

This argument is quite contrary to modern practice. Rubner[3] however brought out this point clearly some time before when he suggested that the diet of the growing infant should be relatively poor in protein. He based his finding on the results obtained in studying the nitrogen metabolism, which showed that a child kept up normal growth when 7 per cent. of its total energy intake was in protein; that 5 per cent. was sufficient for maintenance; that even 4 per cent. was sufficient to supply its actual need when amply supplied with carbohydrate.

Rubner's original discussion is appended in footnote 3.

Whether a child be fed naturally or artificially, therefore, it is evident that protein up to a maximum of 7 per cent. of its caloric need will meet all its requirements.

In the course of its existence the child increases in musculature and activity; its "wear and tear" quota increases and the "growth impulse" impels the organism to increase its bulk of protoplasm, and thus there is generated an active demand for protein. Should this demand be not supplied, then, according to Rubner[4] the "growth impulse" becomes latent, there is no growth, even "wear and tear" is not taken care of. Again, should this demand be just supplied, then growth takes place and tissue is renewed. But what results when protein is supplied in excess? Can it stimulate growth? In reply to this Rubner[5] ten years ago said: "Growth is not proportional to the quantity of the protein in the diet." "Protein cannot raise the rapidity of growth above the limits set by nature."

---

2. Howland: Harvey Society Lecture, March 29, 1913.

3. Rubner: Im Hinblick auf diese Verhältnisse ist es schon in hohem Masse interressant, dass in der Wachstumkost die von Heubner und mir beobachteten Saüglinge überhaupt nur 7 per cent. in Kalorien in Eiweiss geboten waren, und dass bei Erhaltungskost sogar nur 5 per cent. des Kalorienumsatzes auf Eiweiss treffen, ja wenn man die Resorptionsverhaltnisse noch mit heran zieht, so reichte der Säugling vollkommen für seine Bedürfnisse mit einem Umsatz, von dem nur 4 per cent. auf das Eiweiss treffen, Arch. f. Hyg., 1908, lxvi, 97.

4. Rubner: Arch. f. Hyg., 1908, lxvi, 109.

5. Rubner: Arch. f. Hyg., 1908, lxvi, 110.

What, then, becomes of the additional protein fed, over and above the need for maintenance and growth? To quote Rubner[5] again, "As the amount of the protein in the diet increases, a smaller percentage is utilized [for growth] and the excess of the intake is merely consumed in place of an equivalent of non-nitrogenous food."

The question then naturally arises, can any harm come to a growing organism through the feeding of an excess of protein?

To answer with any degree of thoroughness one must inquire as to the various changes which protein undergoes in its transition from an external food product to the cell of the living organism.

Before being absorbed into the body all protein must be first split into amino-acids, as has been so clearly demonstrated by Abderhalden.[6] These amino-acids when once within the body combine and are builded into the tissues, forming new cells or repairing old ones. But what becomes of those amino-acids absorbed in excess of the need for repair and growth?

Rubner,[7] discussing this point, believes that the excess is eventually oxidized in the same manner as carbohydrate and fat. His original language is appended in footnote 7.

There is a further question, viz., Just what is the effect on the growing organism of the combustion due to the metabolism of the protein? A number of observations have been made which show in part the results which follow an increased ingestion of protein for short periods.

Howland[8] working in Prof. Lusk's laboratory was able to demonstrate an increase in the heat production of 10 per cent. by addition of 15 gm. (5 gm. to each of three feedings) of nutrose, a dried casein product containing 89.06 per cent. protein, to the food of a child 3 months of age, and an increase of 26 per cent., by addition of 30 gm. nutrose per day to the diet of another child 7 months of age.

Table 1, based on Howland's[9] work, shows the effect of excess protein on the carbon dioxid as well as the heat output in Child 1 (3 months old) and Child 2 (7 months old).

---

6. Abderhalden, E.: Synthese der Zellbausteine in Pflanze und Tier, Berlin, 1912, p. 101.

7. Rubner: Das Eiweiss, welches über den bedarf des ersatzes (E) unter das wachsthum (W) hinaus aufgenonommen wird, vertritt dann die sonst verbrauchten Nahrungstoffe, Fett order Kohlehydrate, ist also im gewissen Sinne eine überflüssige Zufuhr und zudem unter Umständen durch die dynamischen Wirkungen ein an sich entbehrlicher Energieverbrauch, Ztschr. f. exper. u. Therap., 1905, i, 1.

8. Howland: Ztschr. f. physiol. Chem., 1911, lxxiv, 1.

9. Howland: Trans. Fifteenth Internat. Cong. on Hyg. and Demog., Washington, 1913, ii, 430.

Murlin and I[10] showed an increase of 12.5 per cent. in the metabolism of a 2 months'-old baby when the proportion of the calories in the food arising from protein was raised from 11 per cent. to 29.6 per cent. Details of the experiment when tabulated are as shown in Table 2.

Before discussing the results of the work covered by this paper I wish to express my thanks to Prof. Lusk, of the Physiological Department of Cornell University Medical College, and Dr. L. E. LaFétra, Chief of the Children's Service in Bellevue Hospital, for many helpful

TABLE 1.—EFFECT OF EXCESS PROTEIN ON CARBON DIOXID AND HEAT OUTPUT IN INFANTS

	Length of Time Studied	Food	CO_2 Per Sq. Meter Per Hr.	Calories Per Square Meter Per Day	Increase Per Cent.
Child 1....	Average of eleven sleeping hours	One-half milk and sugar	17.01	1,094	..
Child 1....	Average of four sleeping hours	Same and 15 gm. nutrose	18.21	1,210	10
Child 2....	Average of seven sleeping hours	Three-fifths milk and 5 per cent. sugar, and 30 gm. malt extract	19.21	1,270	..
Child 2....	Average of five sleeping hours	Same plus 30 gm. nutrose	23.64	1,595	26

TABLE 2.—INCREASED METABOLISM IN AN INFANT FROM INCREASED PROTEIN

	Length of Time Studied	Food	Calories Per Hour	Calories Per Sq. Meter Per 24 Hours	Increase Per Cent.
Child C. P., aged 2 months	Average of four sleeping periods	Dil. cow's milk, 11 per cent. protein cal.	7.32	907.5	....
Child C. P., aged 2 months	Average of two sleeping periods	Eiweissmilk, 29.6 per cent. protein cal.	8.12	1,021	12.5

suggestions and constant encouragement. Thanks are also due to the corps of efficient assistants who very kindly cooperated in the technical operation of the calorimeter. According to a plan outlined by Prof. Lusk it was decided to begin with a low protein diet and determine metabolism on such a diet for this child and then gradually to increase the protein content relatively and actually, maintaining the fat and carbohydrate content as nearly as possible on a level throughout the observations.

10. Murlin and Hoobler: AM. JOUR. DIS. CHILD., 1915, ix, 81.

The child was under observation sixteen days in all, being in the calorimeter two or more hours daily from March 24 to April 10, inclusive, except the two intervening Sundays, March 28 and April 4, during which time thirty-seven periods of one hour each were studied, the first six periods being studied in the respiration chamber devised by Dr. Murlin,[11] in which the metabolism was determined by indirect method and the balance in the small calorimeter of the Atwater-Rosa type in which the metabolism was determined both directly and indirectly. The work of the Murlin apparatus demonstrated its efficiency, since the findings under same conditions of food, repose, time after feeding, etc., were practically identical with those obtained with the Atwater-Rosa calorimeter.

Throughout these entire sixteen days the child was kept on the metabolism frame devised and described by me[12] and seemed in every way as comfortable as in the hospital crib. Without a single exception the urine was completely and accurately collected and daily analysis was made of its nitrogen content.

The caloric value of all food given was determined by bomb calorimetry, and the nitrogen content of each day's feedings was carefully determined by the Kjeldahl method, so that there was a perfect record of the caloric as well as of the protein intake. Incidentally this revealed some startling discrepancies between the supposed and the real value of milk formulas as usually made up, and indicated the very great necessity of actually determining the caloric value of food by bomb calorimetry in all metabolism studies in which the caloric intake is considered. The bomb calorimeter used was that devised by Mr. Riche, under whose guidance the work was done.

The infant chosen for this series of observations was a robust, healthy boy aged 2 months, who had been deserted by his mother after having been brought to the hospital. He had been under observation in the hospital for some time and was gaining in weight, taking his feedings well and the stools were perfectly normal.

The first four days the child was fed on one-third whole milk with 5 per cent. dextrimaltose added, during which time the metabolism on low protein diet was determined. The child was then placed for one day on slightly increased protein diet, and the following day was put back again on low protein diet; this continued each alternate day, gradually increasing the protein intake, until the last five days, when the child was placed on maximum quantities of protein in the form of albumin milk prepared by the Walker-Gordon Laboratory. The protein on certain of these days was increased by the addition of nutrose, and on the last day double strength albumin milk was fed.

---

11. Murlin: Am. Jour. Dis. Child., 1915, ix, 43.
12. Hoobler: Am. Jour. Dis. Child., 1912, iii, 253.

The clinical condition of the child continued normal up to the last two days of the series, when it was noticed that the child no longer took an interest in his surroundings, and gradually entered into a state of semistupor. The pulse was slower and there were times when the respirations were slightly irregular. The stupor continued for a few days after the observations ceased. The child on being taken off the metabolism bed was put back on the same diet on which he was before the studies began. The stupor gradually lessened, so that within one week the child was normal again and began to gain in weight.

During the first eleven days the weight gradually increased, but there was a rapid loss during the last five days. The quantity of urine diminished greatly but no acetone bodies were present and the

TABLE 3.—ENERGY METABOLISM WHEN FED ON COW'S—

Date, 1914	Period No.*	Weight in Gm.	Surface Area per Sq. Meter y=mx+b (Howland)	Kind of Food	Distribution of Cal. in Food	Cal. per Kilo.	Cal. in Last Feeding	Cal. in 24 Hrs.
3/24	1	4,364	0.2830	Diluted cow's milk with sugar added	P.11%-F.25%-CH.64%	80	39	351
3/25	1	4,371	0.2840	Diluted cow's milk with sugar added	P.12%-F.27%-CH.61%	74	36	324
3/26	1	4,350	0.2830	Diluted cow's milk with sugar added	P.12%-F.27%-CH.61%	74	36	324
3/27	2	4,350	0.2830	Diluted cow's milk with sugar added	P.14%-F.27%-CH.60%	74	36	320
4/ 1	1	4,406	0.2858	Diluted cow's milk with sugar added	P.12%-F.27%-CH.61%	77	42	338
Av. of 5 sleeping periods		.....	.....	.....	P.12.2%-F.26.4%-CH.61.4%	76	38	331.4

* Sleeping periods only used.

stools became yellow and watery. The temperature was taken both in the calorimeter and in the ward and at no time was it found to be above normal, but on the contrary was slightly below normal at times.

The deleterious results of feeding large amounts of protein has already been hinted at under the term *"Eiweissnährschaden"* by Salge,[13] but he was unable to give the specific clinical symptoms accompanying such injury, and so far as I am aware the clinical symptoms above described have never before been charged to an excess of protein in the diet. The condition was not one of so-called acidosis, for it was not accompanied by the dyspnea typical of that state, neither was the carbondioxid output lowered. The urine did not contain the acetone bodies. The appearance also differed from acidosis in that the child lay in a motionless position with eyes wide open and staring. The features were not drawn. There was no difficulty in breathing, but rather there was a slowing of respiration. As soon as the protein

13. Salge: Kinderheilkunde, Berlin, 1912, p. 112.

was diminished the symptoms gradually disappeared and child became normal. It seems to me that symptoms similar to the above but less pronounced may be observed in various stages of malnutrition when children are fed on sugar and fat-poor diet.

Passing now to a study of the tables presenting the work done, we note that Table 3 gives in detail the various data incident to the metabolism studies when the child was fed on a low protein diet. Attention should be called to the remarkable similarity of results obtained from day to day when the child was studied under like conditions of food, repose, time, etc. The average of the five days establishes a metabolism on low protein of 893 calories per square meter of body surface per twenty-four hours.

—Milk (Diluted) and Sugar, Being a Low Protein Diet

Time Since Last Feeding	Respiratory Period	CO_2 per Hr., Gm.	CO_2 per Sq. Meter per Hr., Gm.	O_2 per Hr., Gm.	R. Q.	N in Urine in 24 Hrs., Gm.	N in Feces in 24 Hrs., Gm.	Cal. Produced per Hr., (Calculated)	Cal. Produced per 24 Hrs.	Cal. per Sq. Meter per 24 Hrs. (Howland's Formula)
1 hr. 45 min.	10:45-11:45	3.91	13.8	3.07	0.92	0.924	.3450	10.56	259.5	895
1 hr. 38 min.	10:38-11:38	3.96	13.9	3.19	0.92	1.008	.4090	10.74	256.7	907
2 hrs. 10 min.	11:10-12:10	4.00	14.1	3.20	0.93	1.008	.4090	10.75	259.2	912
1 hr. 54 min.	11:54-12:54	4.13	15.5	3.25	0.92	1.008	.5953	11.31	256.8	907
36 min.	10:36-11:36	4.07	14.2	3.00	0.99	1.169	.2819	10.54	241.6	845
.....	.....	4.01	14.1	....	....	.....	.....	10.78	254.8	893

The standard agrees very closely with that obtained for children under 3 months as published by Murlin and me.[11]

Table 4 gives detailed data of the sleeping hours obtained when the child was fed on a high protein diet. There were ten of these periods and the table shows the results obtained in each period as well as the average of all these periods.

It will be noted that the calories per hour gradually increased as the proportion of protein was increased, and that the average per hour for the ten sleeping hours was 12.74, and that the calories per square meter per twenty-four hours were 1,120.

Table 5 is a comparative table of the averages of the hours on low protein with those on high protein.

It will be noted that the twenty-four hours' caloric intake averaged about the same; that the proportion of protein calories in the food was raised from an average of 12.2 per cent. to 40.2 per cent. and that the resultant metabolism shows an increase of 25.4 per cent.

This confirms the work of Howland and establishes the fact that the protein of cow's milk when fed in excess of need increases the metabolism.

It is important here to discuss the effect on the infant of this increase in heat production.

Generally speaking, it has heretofore been assumed that the heat regulating mechanism of the body could take care of this additional heat without detriment to the growing organism. The only word of caution which has been spoken has been based on the fear that during summer days when the weather is warm this additional heat could not

TABLE 4.—SHOWING ENERGY METABOLISM—

Obs. Day and No.	Period No.*	Weight of Gm.	Surface Area per Sq. Meter y=mx+b (Howland)	Kind of Food	Distribution of Cal. in Food	Cal. per Kilo.	Cal. in Last Feeding	Cal. in Food in 24 Hrs.
2	1	4,390	0.2850	Albumin milk from whole milk plus dextrimaltose	P.16.7%-F.25.6%-CH.57.7%	121	56.0	448.1
6	1	4,406	0.2858	Albumin milk, cream, dextrimaltose, maltose	P.15.1%-F.24.7%-CH.60.2%	74.5	43.6	327.3
8	1	4,406	0.2858	Albumin milk, cream, dextrimaltose plus 5 gm. nutrose	P.21.0%-F.23.8%-CH.55.2%	68.0	55.1	297.7
10	1	4,320	0.2768	Albumin milk with 15 gm. nutrose added	P.43.7%-F.29.3%-CH.27.0%	73.5	38.8	310.7
10	2	4,320	0.2768	Albumin milk with 15 gm. nutrose added	P.43.7%-F.29.3%-CH.27.0%	73.5	38.8	310.7
10	3	4,320	0.2768	Albumin milk with 15 gm. nutrose added	P.43.7%-F.29.3%-CH.27.0%	73.5	38.8	310.7
13	1	3,761	0.2546	Double strength albumin milk from fat-free milk. No sugar added	P.56.2%-F. 0.0%-CH.43.8%	80.0	37.6	300.8
13	2	3,761	0.2546	Double strength albumin milk from fat-free milk. No sugar added	P.56.2%-F. 0.0%-CH.43.8%	80.0	37.6	300.8
13	3	3,761	0.2546	Double strength albumin milk from fat-free milk. No sugar added	P.56.2%-F. 0.0%-CH.43.8%	80.0	37.6	300.8
12	3	4,220	0.2768	Albumin milk with 28 gm. nutrose added	P.50.1%-F.25.0%-CH.24.9%	84.0	50.4	353.9
Av. of 10 sleeping periods	.....	.....	.....	.....	P.40.2%-F.18.7%-CH.41.1%	80.8	43.4	326.2

* Sleeping periods only used.

escape. The heat regulating mechanism in the adult may well be adapted to dissipate this increased heat production, but infants whose heat regulating functions are still partially undeveloped are unable to avail themselves of the many means which the adult uses to get rid of extra heat, such as change of environment or adding to or lessening amount of clothing worn; and the habit of over-dressing babies for fear of "catching cold" tends to increase the difficulty of dissipating the heat due to this increased metabolism.

The cause of this increased metabolism was at one time attributed to the production of "free heat" when protein was oxidized in the

body, but the latest researches of Prof. Lusk[14] show that "amino-acids even when they are not oxidized yield products of metabolism which act as stimuli to induce higher oxidation in that organism. This is a conclusive proof of a true chemical stimulation of protoplasm within the mammalian organism. It explains the specific dynamic action of protein."

Turning our attention to a study of protein retention with the view of determining whether this increased heat is due to protein ingested, protein oxidized, or protein added to the body, Table 6 shows the quantity of protein ingested, oxidized and added to the body, on each

—WHEN FED ON HIGH PROTEIN FOOD

Time Since Last Feeding	Respiratory Period	CO_2 per Hr., Gm.	CO_2 per Sq. Meter per Hr., Gm.	O_2 per Hr., Gm.	R. Q.	N in Urine in 24 Hrs., Gm.	N in Feces in 24 Hrs., Gm.	Cal. per Hr., (Calculated)	Cal. Produced in 24 Hrs.	Cal. per Sq. Meter per 24 Hrs.
32 min.	10:32-11:32	4.15	14.6	3.19	0.95	1.183	.2846	11.08	260.35	913
30 min.	10:30-11:30	4.14	14.5	3.48	0.86	1.113	.1876	11.95	283.43	992
30 min.	10:30-11:30	4.16	14.5	3.04	0.99	1.155	.2309	10.77	253.89	888
38 min.	10:38-11:38	4.04	14.6	2.97	0.99	2.367	.5182	10.46	243.92	881
1 hr. 38 min.	11:38-12:38	4.36	15.7	4.03	0.79	2.367	.5182	13.45	320.23	1,156
2 hrs. 38 min.	12:38- 1:38	4.77	17.2	4.60	0.75	2.367	.5182	15.35	362.93	1,311
44 min.	10:44-11:44	3.92	15.4	3.65	0.78	2.403	.6457	12.22	300.5	1,178
1 hr. 44 min.	11:44-12:44	4.31	16.9	3.82	0.82	2.403	.6457	12.28	306.0	1,205
2 hrs. 44 min.	12:44- 1:44	4.21	16.5	4.44	0.68?	2,403	.6457	14.71	347.8	1,366
2 hrs. 36 min.	12:36- 1:36	4.50	16.2	4.63	0.71	2.347	.6766	15.13	362.9	1,311
.....	.....	4.256	15.61	....	....	.....	.....	12.74	304.20	1,120

of the days when low protein was given and Table 7 shows the same data for days of high protein ingestion. Table 8 shows the averages compared, indicating an average increase of 49.4 calories on high protein, an increase in metabolism of 20 per cent.

Table 9 shows an increase in an individual period much above the average, this result having been obtained on the day the highest quantity of protein was fed, with an increase in the metabolism of 108 calories or 42.5 per cent., which is the greatest increase yet recorded.

In Table 10 it will be noted that in each of the two periods the same amount of heat was produced and practically the same amount

14. Lusk: Jour. Biol. Chem., 1915, xx, 815.

TABLE 5.—Comparison of Energy Metabolism as Obtained on Diluted Cow's Milk and when Fed on High Protein Milk Mixtures

	Food	Degree of Repose	Distribution of Calories	Cal. in 24 Hrs.	CO_2 per Hr., Gm.	CO_2 per Sq. Meter per Hr., Gm.	Cal. Produced per Hr. (Calculated)	Cal. Produced per Sq. Meter per 24 Hrs.	Increase Per Cent.
5 Hrs.	Low protein diet	Sleeping	P.12.2%-F.26.4%-CH.61.4%	331.4	4.01	14.1	10.78	893	
10 Hrs.	High protein diet	Sleeping	P.40.2%-F.18.7%-CH.41.1%	326.2	4.25	15.6	12.74	1,120	25.4

TABLE 6.—Protein Balance Sheet

Date	Type Diet	Protein in Grams			Total Calories Produced
		Fed	Oxidized	Added to Body	
3/24	Low protein	9.42	6.975	2.445	259.5
3/25	Low protein	9.48	6.870	2.610	256.7
3/26	Low protein	9.48	6.870	2.610	256.7
3/27	Low protein	11.18	9.170	2.010	256.7
4/ 1	Low protein	10.05	8.287	1.763	241.6
Average 5 hours	Low protein	9.90	7.630	2.27	254.8

TABLE 7.—Protein Balance Sheet

Observation Day No.	Period Number	Type Diet	Protein in Grams			Total Calories Produced
			Fed	Oxidized	Added to Body	
6	1	High protein	12.5	8.13	4.37	283.4
8	1	High protein	14.7	8.66	6.04	253.9
2	1	High protein	18.2	9.17	9.03	200.3
10	1	High protein	33.1	19.03	15.07	243.9
10	2	High protein	33.1	18.03	15.07	320.2
10	3	High protein	33.1	18.03	15.07	362.9
13	1	High protein	41.3	19.05	22.25	300.5
13	2	High protein	41.3	19.05	22.25	306.0
13	3	High protein	41.3	19.05	22.25	347.8
12	3	High protein	43.3	18.90	24.40	362.9
Average 10 hours		High protein	31.1	15.6	15.5	304.2

of protein was oxidized. There were also different quantities of protein ingested as well as vastly different quantities of protein added to the body. In each of these periods there was an increase of metabolism of 42.5 per cent. over the heat produced on "low protein" as already shown in Table 9. If this increase in heat production were

TABLE 8.—PROTEIN BALANCE SHEET

Length of Observation	Type Diet	Protein in Grams			Total Calories Produced	Increase in Metabolism*	
		Fed	Oxidized	Added to Body		Calories	Per Cent.
Av. 5 hours...	Low protein	9.90	7.630	2.27	254.8		
Av. 10 hours..	High protein	31.1	15.6	15.5	304.2	49.4	20.0

* The per cent. of increase is here figured on the absolute increase regardless of weight or surface area, hence is lower than when figured on basis of square meter of surface.

TABLE 9.—PROTEIN BALANCE SHEET

	Type Diet	Protein in Grams*			Total Calories Produced	Increase in Metabolism	
		Fed	Oxidized	Added to Body		Calories	Per Cent.
Av. 5 hours...	Low protein	9.90	7.630	2.27	254.8		
12th day	High protein	43.3	18.90	24.40	362.9	108.1	42.4

* Only the third hour is used in computing, as the first and second hour child was restless. This is the highest increase in metabolism due to protein yet recorded.

TABLE 10.—PROTEIN BALANCE SHEET

No. of Observation	Type Diet	Protein in Grams*			Total Calories Produced	Increase in Metabolism	
		Fed	Oxidized	Added to Body		Calories	Pro-tein
10	High protein third period	33.1	18.03	15.07	362.9		
12	High protein third period	43.3	18.9	24.4	362.9		

* These figures show that the increase in metabolism arises from protein oxidized rather than protein added to body. It will be noted that "Protein Oxidized" and "Calories Produced" are the same, while amount "Added to Body" is much increased.

dependent either on the amount of protein ingested or on the quantity of protein added to the body, then the two periods would have differed in heat produced, but the heat produced being the same in each it is evident that the quantity of protein oxidized is the determining factor in the increased heat production. Therefore it follows that the metabolism of protein necessary for growth or for replacement of "wear and

tear" of tissue are not factors in producing this additional heat, but the increase is due to the protein oxidized as shown in Table 10. Since, according to Rubner, all protein not necessary for growth and repair is oxidized, one might conceive that such excess of protein because of its stimulating effect on metabolism might become a positive detriment to the organism. Frequently by reason of the increased metabolism more heat was given off than was supplied in the intake of energy, thus causing the organism to draw on its stored-up supply of energy, as shown in Tables 11, 12 and 13.

Table 11 shows the proportions of the various foodstuffs ingested and metabolized when fed on low protein food. It will be noted particularly that 77.3 per cent. of the protein intake was oxidized and that 86.7 per cent. of the fat and carbohydrate intake was metabolized.

Table 12 shows the same information when the child was fed on high protein.

Table 13 shows a comparison of the averages of the two preceding tables and reveals one of the most interesting facts of this paper. It will be noted that the daily caloric intake on the two diets was about the same, viz., 331 and 326 calories; that the proportion from protein was so much increased that it reduced the caloric intake from fat and carbohydrate, viz., 198.2, considerably below what was being regularly metabolized under low protein feeding, viz., 225. The amount of calories, however, derived from the metabolism of fat and carbohydrate under high protein feeding remained practically the same, viz., 234, as under low protein feeding. In other words, there were 198 calories fed and 234 oxidized. Where, then, did these other 36 calories come from? Undoubtedly from body glycogen and fat.

This shows particularly well in Table 12 on the thirteenth day when there were but 131.5 calories in the food derived from fat and carbohydrate, and yet there were 233.5 calories produced from the oxidation of fat and carbohydrate in the body, or 102 calories more than fed. It seems clear from this that when protein is ingested in high proportions with fat and carbohydrate in relative low proportions, the metabolism process required a certain minimum to be supplied by fat and carbohydrate, and when not supplied, the calories required over and above those ingested must be drawn from the stored up fat and glycogen. In other words, protein food when given in excess, stimulates the infant's metabolism to such an extent that the energy liberated from the increased protein metabolism may be insufficient to furnish this increase in the heat production of the organism. Howland's work showed similar results.

TABLE 11.—Foodstuffs Ingested and Metabolized on Low Protein Diet

Child Fed on Low Protein Diet		Total Food Calories			Protein							Fat and Carbohydrate					
					In Food			Metabolized				In Food		Metabolized			
Day	Period	Intake	Metabolized	Per Cent. of Intake	Calories	Gm.	Per Cent. of Total	Calories	Gm.	Per Cent. of Protein Intake	Per Cent. of Total Food Intake	Calories	Per Cent. of Total	Calories	Per Cent. of Intake of F. & CH.	Per Cent. Derived From	
																Fat	CH.
3/24	1	351	259.5	73.9	38.61	9.42	11	31	6.97	74	11.9	312.3	89	228.5	88.1	20.4	79.6
3/25	1	324	256.7	79.2	38.88	9.48	12	30.5	6.87	72.5	11.9	285.1	88	226.2	88.1	18.7	81.3
3/26	1	324	256.7	79.2	38.88	9.48	12	30.5	6.87	72.5	11.8	285.1	88	228.7	88.2	17	83
3/27	1	320	256.8	80.3	45.84	11.18	14.3	40.75	9.17	81.9	15.8	274.2	85.7	228.5	84.2	18	82
4/ 1	1	338	241	71.3	41.21	10.05	12.2	36.83	8.29	82.4	15.2	296.8	87.8	214.8	84.8	0.0	100
Aver. of five sleeping periods		331	255	77	40.7	9.90	12.3	33.9	7.6	77.3	13.3	290.3	87.7	225	86.7	14.8	85.2

TABLE 12.—Showing Metabolism of Foodstuffs on High Protein Feeding

Child Fed on High Protein Diet		Total Food Calories			Protein							Fat and Carbohydrate					
					In Food			Metabolized				In Food		Metabolized			
Day	Period	Intake	Metabolized	Per Cent. of Intake	Calories	Gm.	Per Cent. of Total	Calories	Gm.	Per Cent. of Protein Intake	Per Cent. of Total Food Intake	Calories	Per Cent. of Total	Calories	Per Cent. of Intake of F. & CH.	Per Cent. Derived From	
																Fat	CH.
2	1	448.1	260.35	58.1	74.6	18.2	16.7	40.75	9.2	56.4	15.6	373.5	83.3	219.6	58.8	0.0	100.0
6	1	327.3	283.43	86.6	49.1	12	15.1	36.13	8.1	73.6	12.7	278.1	84.9	247.3	81.0	43.2	56.8
8	1	297.7	253.89	85.3	62.3	14.7	21.0	38.49	8.6	61.7	15.2	235.4	79.0	215.4	91.5	0.0	100.0
10	1	310.7	243.92	78.4	135.9	33.1	43.7	80.13	18.0	59.0	32.8	174.8	56.3	163.8	93.8	0.0	100.0
10	2	310.7	309.2	100.0	135.9	33.1	43.7	80.13	18.0	59.0	25.0	174.8	56.3	240.1	137.0	74.8	25.2
10	3	310.7	362.93	117.0	135.9	33.1	43.7	80.13	18.0	59.0	25.0	174.8	56.3	282.8	162.0	88.9	11.1
13	1	300.8	300.5	100.0	169.3	41.3	56.2	84.66	19.0	50.0	28.1	131.5	43.8	215.9	164.0	0.0	100.0
13	2	300.8	306.0	102.0	169.3	41.3	56.3	84.66	19.0	50.0	27.7	131.5	43 8	221.4	168.0	59.5	40.5
13	3	300.8	347.8	115.0	169.3	41.3	56.2	84.66	19.0	50.0	24.3	131.5	43.8	263.2	200.0	100.0	0.0
12	3	353.9	362.9	102.0	177.4	43.3	50.1	83.99	18.0	47.3	23.1	176.5	49.9	278.8	159.0	100.0	0.0
Average ten periods		326.2	304.2	93.2	127.7	31.1	40.3	69.37	15.6	54.3	22.9	198.2	59.7	234.8	118.5	46.64	53.36

TABLE 13.—Metabolism of Foodstuffs

	Total Food Calories			Protein							Fat and Carbohydrate					
				In Food			Metabolized				In Food		Metabolized			
	Intake	Metabolized	Per Cent. of Intake	Calories	Gm.	Per Cent. of Total	Calories	Gm.	Per Cent. of Protein Intake	Per Cent. of Total Food Intake	Calories	Per Cent. of Total	Calories	Per Cent. of Intake of F. & CH.	Per Cent. Derived From	
															Fat	CH.
Low protein diet, average of five sleeping hours	331	255	77.0	40.7	9.90	12.3	33.9	7.6	77.3	13.3	290.3	87.7	225	86.7	14.8	85.2
High protein diet, average of ten sleeping hours	326	304	93.2	127.7	31.1	40.3	69.37	15.6	54.3	22.9	198.2	59.7	234	118.5	46.6	53.4

In a study of the output of urinary nitrogen, Table 14, it will be interesting to note that during the low protein periods the average retention was 25.4 per cent. of the intake, while during the days on high protein feeding the retention was increased to 46.8 per cent. of the intake, which showed, therefore, a great relative as well as actual retention.

TABLE 14.—SHOWING NITROGEN RETENTION

Date	N in Food	N in Feces	N in Urine	N Retained	Per Cent. of Intake
3/24	1.507	.0922	0.924	.3450	22.9
3/25	1.509	.0920	1.008	.4090	27.0
3/26	1.509	.0926	1.008	.4090	27.0
1*	1.788	.1747	1.008	.5953	33.3
2	2.913	.2846	1.183	1.4454	49.6
3	1.381	.1350	.952	.294	21.3
4	1.775	.1734	.8946	.707	39.1
5	1.608	.1571	1.169	.2819	17.5
6	1.92	.1876	1.113	.6194	32.2
7	1.49	.1456	.995	.3494	23.4
8	2.3635	.2309	1.1556	.9770	41.3
9	3.382	.3303	1.7190	1.3327	39.1
10	5.304	.5182	2.367	2.4188	47.6
11	3.524	.3443	1.943	1.2367	35.0
12	6.925	.6766	2.347	3.9014	56.3
13	6.607	.6457	2.403	3.5583	53.8

* Observation began. During the last five days of the series the feces were collected and analyzed and the nitrogen content was found to be 2.515 gm. or 0.977 per cent. of the nitrogen intake. The figures for the daily fecal nitrogen are calculated on this basis for entire period.

CLINICAL IMPORTANCE OF FINDINGS

What is the clinical importance of the above findings? It is evident that greater attention should be paid to the relative and actual amount of protein in feeding formulas; particularly is this true in formulas made from whole milk, skimmed milk, buttermilk and albumin milk. Very frequently where there are signs of fermentation these formulas are fed without addition of sugar and the proportion of protein is relatively high. For example: When whole milk, or any of its dilutions, is fed without the addition of sugar, the percentage of calories arising from protein amounts to about 20 per cent.; when skimmed milk or its dilutions are fed without sugar, the protein calories amount to about 30 per cent.; when buttermilk (made from skimmed milk) is used, 40 per cent. of its calories are in the form of

protein; when the original Finkelstein's albumin milk is used having percentages of fat 2.5, carbohydrate 1.5 and protein 3.0 per cent., the proportion of calories due to protein is about 30 per cent. If, as is done both in this country and abroad, albumin milk is sometimes made up from fat-free curd, then the proportion of the protein in such fat-free albumin milk reaches as high as 43 per cent. Just in proportion as sugar is added, the relative percentage of protein calories is diminished as is shown in Table 15.

TABLE 15.—SHOWING RELATIVE DIMINUTION OF PROTEIN CALORIES WHEN SUGAR IS ADDED

	Per Cent. of Formula			Calories in		Per Cent. of Calories From		
	Fat	CH.	Protein	1 Oz.	1 Liter	Fat	Sugar	Protein
Albumin milk without sugar added	2.5	1.5	3.0	12.51	417	55.8	14.7	29.5
Albumin milk with 2% sugar added....	2.5	3.5	3.0	15.27	509	45.9	30.0	24.1
Albumin milk with 5% sugar added....	2.5	7.0	3.0	18.66	622	37.4	42.8	19.8
Albumin milk with 7% sugar added....	2.5	8.5	3.0	21.12	704	33.0	49.5	17.5
Albumin milk with 10% sugar added...	2.5	11.5	3.0	24.71	827	28.1	57.1	14.8

The facts as shown above for albumin milk are also true for other types of milk. In order to bring the proportion of calories derived from protein down to 7 per cent. of total, the amount of sugar added must be considerably increased. For example, for every ounce of whole milk (fat 3.5, carbohydrate 4.5, protein 3.5) used in a formula there should be one-third ounce of sugar added. For every ounce of the top half (7 per cent. fat) one-quarter ounce of sugar should be added. For every ounce of top third (10 per cent. fat) one-sixth ounce of milk sugar should be added.

HOW DETERMINE THE PROTEIN NEED

There have been several general rules applied for determining the protein need, all of which, in the light of these researches, give a higher proportion than is necessary to supply the actual need.

The rule followed pretty generally in this country is that an infant should receive the protein contained in an ounce or an ounce and a half of whole milk per pound weight of child.

Cowie[15] gives the accompanying table (Table 16) as covering the protein requirement.

15. Cowie: AM. JOUR. DIS. CHILD., 1912, iv, 360.

TABLE 16.—PROTEIN REQUIREMENTS

Age	Grams Protein Per		
	Kg.	Pound	Ounce
Two weeks	1.5	.68	.0425
Three weeks	2.0	.90	.056
Four weeks	2.5	1.10	.0687
Two to twelve months	2.5-3.3	1.10-1.5	.093

On the Continent a general rule is that one-tenth of the body weight should be given in whole milk. This, say in a child of 4,500 grams, would mean the protein of 450 c.c. of whole milk. This would require 15 ounces of whole milk. There are 4 calories from protein in each ounce of whole milk, so that a child weighing 4.5 kilos would receive 60 calories of protein. Estimating the total calories needed at 100 calories per kilo the protein supplied would amount to 15 per cent. of the total, which is more than twice the need. Not only is the protein too high according to these general rules, but from latest researches by Benedict and Talbot, by Murlin and Bailey[16] for new-born infants and Murlin and myself[10] for infants between 2 and 12 months, it would seem that the total energy metabolism of infants under 6 months is much lower than that of infants between 6 months and 1 year. Murlin and I[10] collected data showing that the average metabolism of fourteen infants up to and including 4 months of age was 35.4 calories per square meter per hour; the average of seven infants from 6 to 12 months inclusive was 41.9 calories per square meter per hour. Instead, therefore, of feeding 100 calories per kilo under 6 months, and from 70 to 80 calories per kilo from the sixth to twelfth month, the figures should be reversed and 70 or 80 calories per kilo should be fed under 6 months and 100 calories per kilo between 6 and 12 months. Further observations, however, should be made before such a radical change is recommended.

The protein need would therefore be much more nearly supplied if one-half the quantity outlined in these general rules were used, viz., ¾ of an ounce of skimmed, whole or top milk per pound weight of infant, or 1/20 of body weight in skimmed, whole or top milk. This coupled with the rules regarding the use of sugar would enable one easily to determine the need and supply it along with other food elements. Take for example a child weighing 12 pounds. Its protein need is supplied by ¾ ounce of milk per pound; hence the child should

16. Murlin and Bailey: Proc. Soc. Exper. Biol. and Med., 1914, xi, 109.

receive 9 ounces of milk. If this were supplied in the form of whole milk it would be necessary to add to it 3 ounces of milk sugar (or sugar and starch) and diluent sufficient to supply its fluid need. In the 9 ounces of whole milk there would be 180 calories and in the 3 ounces of sugar and starch there would be 360 calories, making in all 540 calories, 36 of which are from protein. A child of 12 pounds needs about 540 calories daily; hence we have both its protein and its calories need supplied.

I have followed the method of feeding low protein for the past three years and it is my belief that children do better, since the method allows the giving of much larger quantities of carbohydrates and fats without overfeeding the child, and readily permits the use of top, whole, skimmed or buttermilk formulas according to the clinical indications of each individual infant. Where large quantities of milk are fed it is necessary to feed relatively low proportions of carbohydrates if one attempts at all to approximate the caloric need.

The foregoing statements are not intended to discourage the use of albumin milk or skimmed or buttermilk without additions of sugar over short periods of time when one desires to secure the therapeutic effect of a food relatively rich in protein and calcium for the purpose of controlling diarrheas, as outlined in an article by Wilcox and Hill.

It is also recognized that every child is a law unto itself in the matter of feeding; particularly is this true in its relation to fat and carbohydrate food, but it would seem that the supply of protein is a much more fixed quantity, since growth of tissue is much more dependent on it than on either fat or carbohydrate.

A series of clinical records are being collected covering cases fed on low protein and will be published separately.

SUMMARY OF FINDINGS

1. Protein when fed in excess of need causes an increase in the energy metabolism.

2. The increase is in proportion to the amount of protein oxidized, and not to the amount of protein added to the body.

3. Protein when fed in excess does not reduce the amount of fat and carbohydrate metabolized, but the fat and carbohydrate need remains fairly constant, and unless the minimal need of fat and carbohydrate is supplied in the food the organism will draw on its stored-up fat and glycogen to supply the difference between the amount fed and that which is metabolized.

4. When protein is fed greatly above its need it tends to produce a condition of stupor which assumes serious proportions if such feeding is continued. This stupor gradually disappears as protein is reduced in the diet. This condition is best considered as a protein food injury

and constitutes a clinical entity as definite in its symptomatology as that which arises from too prolonged use of a rich carbohydrate diet.

5. The protein need of the growing infant is supplied when 7 per cent. of its caloric need is furnished in protein calories.

6. A general rule which will approximate the protein need is to furnish ¾ ounce of whole, skimmed or top milk, per pound weight of child, or if the metric system is applied, 1/20 of the body weight in skimmed, whole or top milk.

7. To keep the protein calories in any formula approximately 7 per cent. of the total, the following rule regarding the addition of sugar or cereal gruels or both may be followed: For each ounce of whole milk add ⅓ ounce of sugar or cereal.[17] For each ounce of top 16 ounces (7 per cent.) milk add ¼ ounce of sugar or cereal. For each ounce of top 10 ounces (10 per cent.) milk add 1/6 ounce of sugar or cereal.

8. It is clearly recognized that rules outlined for feeding for nutritional purposes only cannot be followed when one feeds a food for therapeutic as well as nutritional purposes, hence the feeding of albumin or skimmed milk, i. e., a high protein food, is justified on the ground of its being a therapeutic measure and should be discontinued when the therapeutic indication no longer exists.

---

17. The amount of cereal is estimated by the quantity of the dry cereal used in making the cereal diluent.

STUDIES IN INFANT METABOLISM AND NUTRITION, V

UNDER THE DIRECTION OF L. EMMETT HOLT, M.D., AND
D. D. VAN SLYKE, PH.D.

*The Composition and Preparation of Protein Milk (Eiweissmilch)**

ANGELIA M. COURTNEY AND HELEN L. FALES
NEW YORK

The value of protein milk in disturbances of infantile digestion is appreciated in this country only by the comparatively small number who have used it extensively. It has not yet found its way into general practice and it is in general use in only a few of our hospitals. Many have been deterred from prescribing it owing to the difficulties in preparation as originally published. Much regarding the use of protein milk has been brought out since Finkelstein's original publication in 1910. A simplification and standardization of the method of preparation seems therefore desirable.

Not only a variation in the ingredients used but also the methods employed make noteworthy differences in the composition of the product. To these variations some of the differences in the results are no doubt due. Examination showed that samples of protein milk made in the same diet kitchen by the same nurse and with the same materials differed so widely, especially with respect to the fat content, that a careful study was undertaken to ascertain the effect of the different steps of preparation on the final product and to discover the explanation of these variations.

Finkelstein's[1] original method of preparation as described by him in his early publication is briefly as follows:

> To one liter of milk, one teaspoonful of rennet is added. This is then allowed to stand in a water bath at 42 C. for one-half hour. It is then placed in a linen bag and the whey strained off by suspending this for one hour. The curd is rubbed once or twice through a fine sieve with the addition of one-half liter of water, and one-half liter of buttermilk is then added.
>
> The original milk used contained: fat, 3.5; sugar, 4.5; protein, 3.0; ash, 0.70
> Tho protein milk contained: fat, 2.5; sugar, 1.5; protein, 3.0; ash, 0.50

According to Finkelstein, the beneficial effects of protein milk were due to (1) its low sugar; (2) the dilution of the whey; (3) the high

---

* Submitted for publication July 14, 1915.

* From the Laboratories of the Rockefeller Institute for Medical Research and the Babies' Hospital.

1. Finkelstein and Meyer: Jahrb. f. Kinderh., 1910, lxxi, 525.

casein; (4) a combination of relatively high fat and high calcium, this favoring the production of formed stools.

Protein milk has been frequently described as a food low in salts; in fact, many writers have laid stress on the great reduction of the salts as one of the advantages of protein milk.[2] Rollet[3] proceeds on the assumption that it contains only the salts of the buttermilk which, according to Finkelstein's method of preparation, constitute one-half the fluid volume. Such, however, is not the case. In Finkelstein's and Meyer's own analyses the total salt content is five-sevenths of that of the original milk. But the proportion of the different salts is not the same as in whole milk; while the proportion of the soluble salts is reduced, that of the insoluble salts is increased.

Our analyses, which were first made in connection with metabolism studies, have always shown considerably higher values than those of Finkelstein and Meyer, not only for the total ash but for most of the ash constituents. This may have been in part due to the method of preparation which differed slightly from that of Finkelstein.

In the first place, in order to reduce the sugar content as much as possible, after the whey has been strained off we have washed the curd in sterile water. This was believed not only to reduce the sugar but also the salt content. The extent to which this is accomplished is shown in the analyses given in the subsequent tables.

Again, instead of adding one-half liter of water and one-half liter of buttermilk to the washed curd, only enough water was added to bring the final volume up to one liter, the difference being about 100 to 120 c.c. of water which is displaced by the curd.

Finally, instead of the usual commercial buttermilk which contained about 4 per cent. of sugar, we used a specially fermented milk with but 3.5 per cent. sugar. This, moreover, was never fat-free but contained on the average 0.5 per cent. of fat; besides, there had been added a small amount of table salt. Our analyses showed, therefore, a higher NaCl content than that reported by Finkelstein.

Variations in the Fat.—Since samples of protein milk examined on three successive days gave the fat content as 2.2, 3.5 and 3.1 per cent., respectively, there were evidently conditions in the method of preparation which influenced the final product in an important way, and it was the purpose of our investigation to find out what these were, and to devise a method which reduced these variations to the minimum.

The causes of variation were apparently dependent on at least three different factors, any one of which might influence the per-

2. Leopold: Arch. Pediat., 1910, p. 602.
3. Rollet: Berlin Klin. Wchnschr., 1911, p. 835.

centage composition of the product, viz., (1) The percentage composition of the ingredients used. Although purchased from a large dealer the variation in the fat percentage in the whole milk from day to day was found to be over 0.5 per cent. (2) The conditions under which the curd was formed seemed important—the temperature, the time of standing, the amount of rennet added, the amount of the protein milk made at one time, etc. (3) The manner of manipulation in the straining, the washing of the curd and in the rubbing through the sieve, all had an effect on the composition of the product.

In order to decide these questions protein milk was made under varying conditions. It was prepared in different quantities varying from 1 to 10 liters at a time; the amounts of the elements used were accurately measured as well as the quantity of the final product. Complete analyses were made of the ingredients used—the milk, the buttermilk and the junket tablets; of the waste products—whey and washings; and of the final product, the protein milk. Analyses of the fat were made many times, this being the constituent which varied most. A smaller number were made of the protein, sugar and salts. It soon became evident that the chief causes of variation were to be found in conditions which affected the firmness of the curd. A firm curd held the fat more closely bound, and neither the fat nor the casein passed through the gauze in any appreciable amount; while if the curd was soft, a considerable amount of both fat and casein were lost in the whey.

The routine procedure followed in the hospital diet kitchen was found to be as follows:

> A quantity of whole milk, usually eight or ten liters, was heated to about 100 F. and into it was gently stirred for a moment one junket tablet, dissolved in a small amount of water, for each liter of milk. The milk was left standing, covered, at the temperature of the room, usually about 72 F., for thirty or forty minutes. It was then poured on two thicknesses of cheese cloth, by tilting which the curd was gently rolled from side to side and the whey drained away in the course of eight or ten minutes. Water was then poured on the curd and the manipulation repeated. This washing was done twice. The curd was then placed on a fine wire sieve, fifty meshes to the inch, and rubbed through it with a metal vegetable masher, with the gradual addition of one-half liter of buttermilk to each liter of whole milk used for the curd. Enough water was then added to make the volume equal to that of the original milk.

It had long been a tradition of the diet kitchen that "good protein milk" could not be made from so small an amount as one or two liters made from one or two liters was far below the average in fat content, as can be seen from the following experiments.

From one lot of whole milk containing 3.3 per cent. fat, one-liter and four-liter samples were taken; from another lot containing 3.5 per cent. fat, one-liter, two-liter and four-liter samples were taken.

Protein milk was made from each of these samples, the condition being kept as nearly as possible the same for all. The results are given in Table 1.

The figures showed extraordinary variation in the fat. That made from the first lot showed in the one-liter sample 2.15 per cent. fat; in the four-liter sample, 2.70 per cent. fat. In the second lot, the one-liter sample gave 1 per cent. fat; the two-liter, 1.6 per cent.; the four-liter sample, 2.37 per cent. (Vide analyses 1 to 5, Table 1.) In two ten-liter samples (Nos. 6 and 7) made from milk containing 3.6 per cent. fat the fat in the product was respectively 2.34 and 2.90 per cent. It would appear from this that the percentage of fat in the product is distinctly lower if only one or two liters, instead of a larger amount of milk, is used; but that above this quantity the exact amount used is not important.

The reasons for the difference between large and small quantities seemed to be two: A certain amount of the fat always adhered to the cheese cloth. In the one-liter samples the proportion of this to the whole amount of fat was considerable, while in the large samples the proportion to the whole was small. Again, in the manipulation of the curd used to remove the whey, the small curd broke apart more readily than the large curd, and consequently a larger proportion of the fat and casein were lost in the whey and in the washing. This made it clear that a method of removing the whey which involved less manipulation of the curd would insure a more uniform product and higher percentage of fat and of protein. This was demonstrated to be the case by the following experiments:

Two four-liter samples were measured from the same milk. The curd from one was handled in the usual way. That from the other was drained by suspension for two hours, the procedure in other respects being the same in both cases. From each of two other lots of milk three three-liter samples were taken. The curd in one sample in each group was drained by manipulating the gauze in the usual manner; that of another was suspended ten minutes and then manipulated till dry; that of the third was suspended for two hours without any manipulation. (Vide analyses 8 to 15, Table 1.)

In general these observations showed that the less the curd is manipulated in removing the whey, the higher the percentage of fat in the protein milk.[4] Of the four-liter samples the one in which the whey was removed by suspension showed 3.5 per cent., while the one

4. These experiments have proceeded on the assumption that a low fat was not generally desired in protein milk. The hospital experience has been that one of its chief advantages is its rather high fat content. However, should one wish to secure a low fat with high casein, skimmed milk, instead of whole milk, should be used in its preparation.

TABLE 1.—Variation in Fat of Protein Milk Due to Differences in Quantity Prepared and to Different Methods of Handling

No.	Quantity of Milk Used for Curd, c.c.	Method of Draining Whey from Curd	Grams in Milk Per Liter	Grams in Whey Per Liter	Grams in Wash Per Liter	Grams in Curd (by Subtraction)	Per Cent. of Amount in Original Milk in Curd	Grams in Buttermilk Per Half-Liter	Grams in Protein * Milk Per Liter (By Estimation)	Grams in Protein * Milk Per Liter (By Determination)
1	1,000	Entirely drained by handling in cheese cloth	33	8.36	6.50	18.14	55.0	4.0	22.14	21.50 †
2	4,000	Same	33	4.61	4.74	23.65	71.7	4.0	27.65	27.00
3	1,000	Same	35	18.25	7.00	9.75	27.9	5.5	15.25	10.00
4	2,000	Same	35	16.17	2.60	16.23	46.4	5.5	21.73	16.00
5	4,000	Same	35	12.28	1.73	20.99	60.0	5.5	26.49	23.70
6	10,000	Same	36	11.57	2.31	22.12	61.4	3.5	25.62	23.40
7	10,000	Same	36	9.00	.99	26.01	72.2	3.5	29.51	29.00
8	4,000	Same	35	19.26	2.40	13.34	38.1	4.0	17.34	11.00
9	4,000	Drained by suspending 2 hours	35	3.20	‡	31.80	90.9	4.0	35.8	35.00
10	3,000	Drained entirely by handling	35	12.91	1.26	20.83	59.5	4.5	25.33	24.00
11	3,000	Drained 10 minutes by suspension; rest by handling	35	6.35	1.73	26.92	76.9	4.5	31.42	31.00
12	3,000	Drained by suspending 2 hrs.	35	2.96	2.27	29.77	85.0	4.5	34.27	34.00
13	3,000	Drained entirely by handling	31	8.23	1.20	21.57	69.6	3.5	25.07	24.50
14	3,000	Drained 10 min. by suspension; rest by handling	31	5.31	.99	24.70	79.7	3.5	28.20	28.00
15	3,000	Drained by suspending 2 hours	31	2.99	2.86	25.15	81.1	3.5	28.65	25.50
16	2,000	Drained by resting on sieve 10 minutes, then by handling	30	6.36	1.68	21.96	73.2	3.5	25.46	25.00

* The amount of fat by estimation is necessarily higher than that obtained by determination because of the amount lost on utensils.
† The figures given in this column show the grams per liter; the per cent. is obviously one-tenth of this. ‡ By mistake this curd was not washed.

manipulated showed but 1.1 per cent. One of the three-liter series gave the following values: Fat in sample suspended two hours, 3.4 per cent.; fat in sample suspended ten minutes and then manipulated, 3.1 per cent.; fat in sample manipulated without suspension, 2.4 per cent. The other series gave similar results. The apparent exception will be referred to later.

As a result of these observations the following procedure was adopted:

> The whole milk is coagulated as above described. After standing for thirty minutes the coagulum is poured on a doubled piece of ordinary cheese-cloth and allowed to remain for fifteen minutes, the cloth resting on the sieve through which the curd is later to be pressed. The cheese-cloth is then gently manipulated for a few minutes to complete the removal of the whey. The curd is now washed twice, using each time about one-fifth as much water as the original amount of milk taken. The water is poured on the curd, which is then gently manipulated for two or three minutes. The curd is then transferred to the sieve and pressed through it with the gradual addition of half as much buttermilk as the volume of whole milk taken. Boiled water is then added to make the volume equal to that of the original milk used. Great care must be taken in pressing the curd through the sieve lest the fat be transformed into butter, which often adheres to the sides of the utensils or floats on the surface of the milk. This is avoided by rubbing gently in one direction, the rotary motion being almost certain to form butter. A fat determination in such a sample is manifestly unreliable. (Vide analysis 15, Table 1.)[5]

A series of over thirty observations (Table 2) was carried out to determine to what extent uniformity of fat content was secured with the method of handling the curd just described. On successive days samples of the original milk, the buttermilk and the protein milk were analyzed for fat. In protein milk made from the same milk supply by different persons there was a great variation in the amount of fat retained; it ranged between 52 and 86 per cent. of the fat in the original milk. (Vide analyses 1 and 2, Table 2.) When made by a single experienced person, not only was the fat in the protein milk more nearly uniform but the actual loss of fat was much less. In one instance, the range of fat retained was from 86 to 97 per cent. of the fat in the milk; in another, 76 to 79 per cent.; in a third, 93 to 97 per cent. (Vide analyses 3 to 5, Table 2.)

From these figures the proportion of the fat of the whole milk retained in the curd and consequently in the protein milk is easily estimated. With proper handling fully four-fifths of the fat of the whole milk used is retained in the protein milk. But the total fat of the protein milk contains also a small amount of fat in the buttermilk. If commercial buttermilk is used, however, this is a negligible quantity.

---

5. The loss of fat in whey and washings indicates that the fat value of the protein milk is too low.

TABLE 2.—VARIATIONS IN THE FAT OF PROTEIN MILK WHEN PREPARED ACCORDING TO A PROPER METHOD, BY DIFFERENT PERSONS

No.	No. of Determinations Considered	By Whom Prepared	Range of Fat Percentage in Whole Milk Used	Average Per Cent. of Fat of Whole Milk	Range of Fat Percentage in Buttermilk Used	Average Per Cent. of Fat of Buttermilk	Range of Fat Percentage of Protein Milk	Average Per Cent. of Fat of Protein Milk	Range of Per Cent. of Whole Milk Fat Held in Curd	Average Per Cent. of Whole Milk Fat Held
1	10	Prepared by various persons	3.00-3.65	3.37	0.35-0.75	0.55	2.45-3.35	2.78	61-86	74.2
2	10	Prepared by various persons	3.15-3.40	3.29	0.40-1.70	0.68	1.95-3.35	2.76	52-83	73.6
3	6	Prepared by Nurse A	3.00-3.30	3.10	0.5 -0.6	0.57	3.0 -3.20	3.09	86-97	90.6
4	4	Prepared by Nurse B	3.00-3.90	3.44	0.65-0.90	0.79	2.65-3.90	3.08	76-79	78.0
5	2	Prepared by Nurse C	3.00-3.00	3.0	0.8 -0.8	0.80	3.20-3.30	3.25	93-97	95.0

TABLE 3.—AVERAGE COMPOSITION (FAT, SUGAR, PROTEIN, TOTAL ASH) OF PROTEIN MILK, OF THE INGREDIENTS USED, AND OF THE WHEY AND THE WASH (FROM FIVE ANALYSES)

	Grams in Milk Per Liter	Grams in Whey Per Liter	Grams in Wash Per Liter	Grams in Curd (by Subtraction)	Per Cent. of Amount in Original Milk in Curd	Grams in Buttermilk Per Half-Liter	Grams in Protein * Milk Per Liter (By Estimation)	Grams in Protein * Milk Per Liter (By Determination
Fat	34.0	5.65	2.14	26.21	77.1	4.0	30.21	29.8
Sugar	46.7	41.53	4.89	0.28	0.6	18.06	18.34	22.0
Protein	31.9	7.71	1.62	22.57	70.8	15.36	37.93	37.5
Total Ash.....	7.934†	4.751	0.597	2.586	32.6	4.034	6.620	6.528

* The values for the ingredients of protein milk obtained by estimation are necessarily greater than those obtained by determination because of the amount lost on utensils.

† The salt of the junket tablets used in coagulating the milk is included in the total ash of the milk.

Consideration of the figures given in the foregoing table forces one to the conclusion that a very important factor in insuring a uniform fat in protein milk is the care used in the various steps of the operation.

The method of preparation which has been described above is the one to be recommended where considerable quantities of protein milk are to be made at one time, as for hospital use. If only one or two liters are desired, or it is to be made by an inexperienced person, the chances of error are much less if all the whey is drained away by suspension of the curd.

The other constituents—sugar, protein and salts—as has been already suggested, vary much less than does the fat.

The Sugar.—The sugar content of the original milk used ranged from 4.5 to 4.8, the average being 4.7 per cent. When the protein milk is properly made there is removed in the whey and in the washing nearly all the sugar of the original milk. On the average, about nine-tenths of what is removed comes out in the whey, and one-tenth, in the washing. The percentage of sugar in the protein milk should therefore be only about one-half that in the buttermilk. The figure for sugar in all our analyses was obtained by the reduction method. Owing to the difficulty of removing the protein from the protein milk before determining the sugar value, the figure for sugar is probably too high. Our average sugar figure in protein milk made under proper conditions is about 2 per cent. This figure is obtained from a larger number of determinations than are included in Table 3. The apparent error, assuming the curd to be nearly sugar-free, is therefore, 0.2 per cent. The actual sugar content of protein milk carefully prepared, as above described, must average about 2 per cent., using commercial buttermilk, or a little less than 1.8 per cent., using the specially fermented milk.

The Protein.—The percentage of protein in the protein milk is influenced by the same conditions as those which affect the fat, but to a less degree. The protein of the whole milk used averaged 3.25 per cent. When properly made there is lost in the whey 0.77 per cent.; in the washings, 0.16 per cent. Besides the lactalbumin, this must include some of the casein mechanically carried through. Some is also left on the utensils. The protein of the buttermilk used averaged 3.07 per cent. The total percentage of protein of the product would be half this (since the buttermilk represents one-half the volume) plus the curd protein which, after deducting the loss in the whey and the waste, leaves about 2.26 per cent. of the original milk. By addition this would make the protein content of the protein milk 3.79 per cent.; by determination it was 3.75; the range being 3.60 to 4.00 per cent. Of this protein only about 0.25 is lactalbumin, about 3.50 being casein.

TABLE 4.—Distribution of the Salts of the Ash of Protein Milk, of the Ingredients Used, and of the Whey and the Wash (From Five Analyses)

	Grams in Milk Per Liter	Grams in Whey Per Liter	Grams in Wash Per Liter	Grams in Curd (by Subtraction)	Per Cent. of Amount in Original Milk in Curd	Grams in Buttermilk Per Half-Liter	Grams in Protein * Milk Per Liter (By Estimation)	Grams in Protein * Milk Per Liter (By Determination)
CaO	1.757	0.486	0.108	1.163	66.2	0.833	1.996	1.930
MgO	0.199	0.101	0.015	0.083	41.7	0.104	0.187	0.180
P_2O_5	2.060	0.796	0.140	1.124	54.6	1.024	2.148	2.121
K_2O	1.887	1.514	0.167	0.206	10.9	0.828	1.034	1.028
Na_2O	0.770†	0.636	0.070	0.064	8.3	0.511	0.575	0.563
Cl	1.420†	1.148	0.120	0.152	10.7	0.764	0.916	0.868

* The values for the ingredients of protein milk obtained by estimation are necessarily greater than those obtained by determination because of the amount lost on utensils.

† The NaCl of the junket tablets is included in that of the milk.

TABLE 5.—Comparison of the Salts of Different Milks

	Total Ash, Per Cent.	CaO	MgO	P_2O_5	K_2O	Na_2O	Cl
Protein milk (12 analyses)	0.648 *	0.201	0.021	0.222	0.109	0.032 *	0.061 *
Cow's milk (5 analyses)	0.743	0.176	0.020	0.206	0.189	0.050	0.111
Woman's milk (16 analyses of normal mature milk)	0.206	0.047	0.008	0.034	0.057	0.014	0.035

* This figure is obtained after subtracting for the NaCl added to buttermilk used in our experiments.

By the method of preparation—precipitation and mechanical subdivision—this large amount of casein is readily held in suspension and passes through the ordinary rubber nipple. If carefully warmed for feeding this suspension is not interfered with. But owing to the acidity of the milk any considerable degree of heat causes a separation and precipitation of the casein in large masses.

The Salts.—So much has been said of the salts in the literature of protein milk that the total salts and the distribution of the salts were made a subject of special study. In general it was found, as was anticipated, that the soluble salts of the original milk were largely removed in the whey and in the washings, while a large part of the insoluble salts was retained in the curd.

There	is	retained	in	the	curd	62.5	per	cent.	of the	CaO	of the whole milk
"	"	"	"			39.9	"	"	"	MgO	" " "
"	"	"	"			53.5	"	"	"	P_2O_5	" " "
"	"	"	"			10.7	"	"	"	K_2O	" " "
"	"	"	"			6.4	"	"	"	Na_2O	" " "
"	"	"	"			7.2	"	"	"	Cl	" " "

The salts of the final product will therefore be the salts of the buttermilk plus those retained in the curd. In Table 4 is shown the quantity of each of the salts in the milk and buttermilk used, also the amount removed in the whey and the washings and the amount present in the protein milk.

In Table 5 is shown the salts of protein milk compared with those of cow's milk and woman's milk.

It will be noted that the proportion of CaO and P_2O_5 in protein milk is slightly higher than in cow's milk while that of MgO is practically the same in both. A reduction is seen only in K_2O, Na_2O and Cl, the amount of which is but little over half as great as in whole milk.

As compared with woman's milk, not only are the total salts of the ash in great excess, but the amount of calcium is nearly five times, and the phosphorus, nearly seven times as great. The soluble salts also are nearly twice as abundant in protein milk.

To the large excess of insoluble salts, especially calcium, is no doubt to be ascribed the value of protein milk in producing formed stools.

From these observations there is found no basis for the statement that protein milk is low in salts, since it contains not only a higher total ash, but higher amount of all the different salts than are ordinarily given to infants artificially fed. Even when protein milk is diluted, the amounts are much greater than nursing infants receive. The advantages of its use cannot therefore be attributed to the amount of salts removed, nor can the failure to gain weight be ascribed to the absence of the usual salts of the whey. The lowering of the Na_2O

and Cl in the preparation of the protein milk seems to be of no special advantage. As used in the Babies' Hospital extensively for three years with most satisfactory results, it has contained, owing to the addition of NaCl to the buttermilk used, an amount of these elements nearly as great as in cow's milk and much greater than that in woman's milk.

CONCLUSIONS

1. The chief variation in the composition of protein milk is in the fat. Uniformity is secured not only by the use of ingredients of uniform composition, but, what is much more important, by the exercise of great care in the handling of the curd. It should be suspended for a short time or allowed to rest for fifteen minutes on the sieve before manipulation to drain off the whey; care in pressing the curd through the sieve is also essential.

2. Since the value of protein milk is in large measure due to its low sugar content, the washing of the curd with water is a useful means of removing an additional amount of sugar.

3. When properly prepared the amount of protein in protein milk is quite constant and is usually somewhat greater than that of the original milk; it is nearly all casein.

4. If the buttermilk is added while the curd is being rubbed through the sieve, it is unnecessary to repeat this part of the process.

5. In the ash of protein milk the amount of calcium and phosphorus is slightly greater, that of sodium, potassium and chlorin is less than in whole milk, being reduced to a little more than one-half the proportion present.

6. Certain things are to be avoided in preparing protein milk: (1) stirring too much or too long while adding the rennin; (2) leaving the milk during curd formation in a cold place; (3) any unnecessary handling of the curd in straining off the whey or in washing or in pressing through the sieve; (4) subsequent heating beyond that required in feeding.

7. The composition of protein milk obtained from all our analyses when made as above described is: Fat, 3.0 to 3.50 per cent.; sugar, 1.8 to 2.0; protein, 3.60 to 4.00; ash, 0.65.

REFERENCES

In addition to the authors referred to in the text, the following may be consulted:

Pelka: Ztschr. f. Kinderh., ii, 442.
Various modifications of protein milk:
Stoelzner: München. med. Wchnschr., 1913, vi, 291.
Heims: Monatschr. f. Kinderh., 1913, xi and xii, 621.
Bertlich: Ztschr. f. Kinderh., 1913, Nos. 3, 5, 9.
Engel: Deutsch. med. Wchnschr., 1913, p. 26.
Kern and Müller: Berlin klin. Wchnschr., 1913, p. 2237.
Hoobler: Arch. Pediat., 1914, p. 171.

THE DIAGNOSTIC SIGNIFICANCE OF D'ESPINE'S SIGN *

HENRY FARNUM STOLL, M.D.
Assistant Physician to the Hartford Hospital, Physician to the Outdoor School
HARTFORD, CONN.

"The duration of pulmonary consumption in children varies; but it is generally more rapid with them than with adults, as in a large proportion of cases the tubercular disease commences in young subjects in the bronchial glands, and remains often for a considerable time unnoticed especially when unattended by a cough. The length of time during which tuberculization may have been proceeding before it is discovered is generally very uncertain. The suppuration or softening of tubercles in the bronchial glands very rarely occurs without corresponding diseases afterwards appearing in some parts of the lungs, which affords all the characteristic symptoms of pulmonary phthisis. The disease has, however, proved fatal, having been accompanied with decided hectic fever, when the bronchial glands alone have been found to be the seat of the malady." So wrote Coley[1] in 1846.

Nevertheless it was not until within comparatively recent years that it was deemed possible by means of physical signs to detect their enlargement, so deeply do they lie within the thoracic cavity. In 1907 D'Espine[2] drew attention to a sign that he had observed for many years and considered diagnostic of enlargement of these glands. He stated that in young children the whispered voice normally ceases at the level of the seventh cervical spine posteriorly. When, however, there is enlargement of the lymph nodes and the patient whispers "three thirty three" bronchophony is heard over the upper thoracic spine as well. Although considerable evidence has been brought forward in support of D'Espine's contention, clinicians are far from agreeing as to its real value, many disregard it entirely. In an article dealing with tuberculosis in children Landis[3] makes no mention of D'Espine's sign or of increased whisper in the interscapular space. He does, however, express the opinion that percussion of this region is unreliable for the detection of glandular enlargement.

* Submitted for publication June 18, 1915.

1. Coley: A Practical Treatise on the Diseases of Children, Jas. Milman, 1846.
2. D'Espine: Bull. de l'Acad. de méd., Paris, 1907, lvii, 167.
3. Landis: Am. Jour. Med. Sc., 1914, cxlviii, 530.

Manges[4] in an article dealing with the value of the whispered voice in detection of small areas of consolidation in the lung makes no mention of D'Espine's observations, and apparently he does not consider the whispered voice of especial significance over the hilum region, as he believes that "normally in a number of individuals the whispered bronchial voice can be heard distinctly, especially in children . . . near the large bronchi." In England the import of whispered bronchophony in detecting enlargement of the bronchial glands does not appear to be appreciated. Ewart, long an advocate of spinal percussion and more recently of paravertebral percussion, appears to ignore it completely.

Riviere[5] refers to D'Espine's sign, but he is of the opinion that percussion gives the more trustworthy results. Percy Kidd[6] also gave an adverse report, but as he counted the test positive in adults when heard only as low as the first and second thoracic spines, this criticism loses its weight.

Lees[7] reporting four cases of incipient pulmonary tuberculosis in children recently, refers to dulness over the hilum and to "deficient air entry" in the affected region, but one looks in vain for any statement as to the character and area of transmission of the whispered voice.

In an article dealing with hilum tuberculosis in children, Cullen[8] dismisses the physical signs with the statement that "pressure signs and symptoms occupy many pages of textbooks; in practice they may be safely disregarded."

Jordan[9] of Guy's Hospital seems to share the same view as to the utter untrustworthiness of all physical signs, for he tells us that "the only known method of making a diagnosis of peribronchial phthisis is the Roentgen method." "Radiography holds the field alone," he asserts.

On the other hand, Dautwitz[10] in a most exhaustive article extolling the value of physical signs in the detection of hilum tuberculosis expresses the opinion that whispered bronchophony is unquestionably of the most value, though he holds light percussion in high esteem. With this opinion Gesteira[11] of Rio de Janeiro agrees. He asserts

---

4. Manges, M.: Tr. Am. Climat. Assn., 1912, xxviii, 132.
5. Riviere, Clive: Early Diagnosis of Tubercle, New York, Oxford University Press, 1914.
6. Kidd, Percy: Lancet, London, 1911, i, 561.
7. Lees, D. B.: Practitioner, London, 1915, xciv, 373.
8. Cullen, J. P.: Practitioner, London, 1915, xciv, 610.
9. Jordan, A. C.: Practitioner, London, 1912, lxxxviii, 248.
10. Dautwitz: Beihefte z. med. Klin., 1908, iv, No. 9.
11. Gesteira, J. M.: Brazil Med., 1913, xxvii, Nos. 2 and 3; Abstr. in Jour. Am. Med. Assn., 1913, lx, 873.

that in Brazil, D'Espine's sign is regarded "as the most reliable and easiest to apply of all means for revealing the presence of tuberculous processes in the tracheobronchial lymphnodes."

Zabel[12] also holds this sign in high esteem, as he often found it the only sign pointing to abnormality of the bronchial glands. He mentions a number of clinicians (Bard, Leroux, Krautz, Roch) who are of the same opinion.

Smith and Sweet[13] examined one hundred patients; the twenty who showed dulness at the lung root in each instance gave a positive D'Espine sign and a hilum lesion was revealed by the Roentgen ray.

Seventy cases of the one hundred exhibited a positive D'Espine's sign and of those 92.8 per cent. had positive Roentgen-ray findings.

Smith and Sweet concluded that except in rare instances a positive D'Espine's sign means enlarged bronchial glands. Occasionally owing to the situation of the glands, the whispered voice may not be detected, even in the presence of glandular enlargement as revealed by the Roentgen ray.

I have been interested in this question for several years.[14] Not only have I been able to compare the physical signs with the Roentgen-ray negative in a considerable series of cases, but several times I have observed the whisper grow markedly less over a period of several months as the general condition of the patient improved. Roch[15] noted the same thing in an adult with enlargement of both cervical and bronchial glands.

The control of these signs by necropsy does not appear to be very large. In a number of instances D'Espine has demonstrated glandular enlargement; and Smith and Sweet,[13] found a marked enlargement in one case which had exhibited a positive sign.

I have had a limited opportunity to compare these signs with the postmortem findings. In a few cases not presenting any increased whisper, no enlargement of the bronchial glands was found. Four exhibited a marked D'Espine and all had large bronchial glands.

The last case, that of a girl of 10 years, was of especial interest as the patient had been under close observation for a number of months and had a Roentgen ray taken shortly after the onset of her illness. She was referred to me by Dr. Walter G. Murphy in August, 1912, because of marked enlargement of the cervical glands. Her mother stated that she seemed extremely tired—too tired to play in

12. Zabel: München Med. Wchnschr., 1912, lix, No. 49; Abstr. in Jour. Am. Med. Assn., 1913, lx, 250.

13. Smith and Sweet: Am. Jour. Dis. Child., 1914, viii, 228.

14. Stoll, H. F.: Am. Jour. Med. Sc., 1911, cxli, 83.; Am. Jour. Med. Sc., 1914, cxlviii, 369; Am. Jour. Dis. Child., 1912, iv, 333; Boston Med. and Surg. Jour., 1912, clxvii, 291.

15. Roch: Semaine méd., 1911, xxxi, 85.

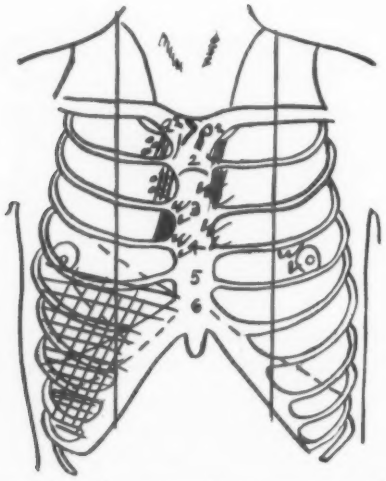


Fig. 1.—Breath sounds faint everywhere; ooo = râles; shaded area = impaired resonance; wv= whispered voice. Noteworthy point: 1, marked dulness, third space; 2, accentuated aortic second sound; 3, whispered voice along border of sternum. Compare with situation of glands D, D¹, E, Figure 3.

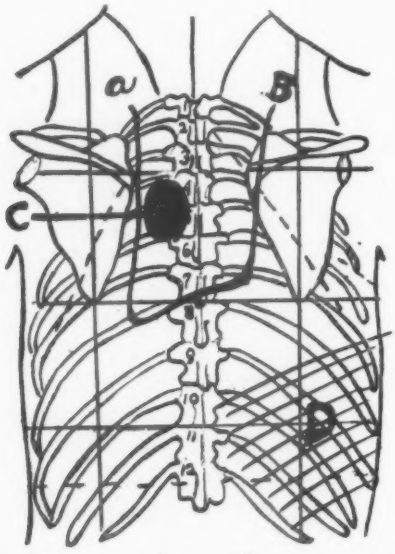


Fig. 2.—Line A-B shows area where whispered bronchophony was present; C, site of more marked whisper. (Compare with C, Figure 4) D, dulness—distant breath sounds.

fact—and her appetite was very poor. It is especially noteworthy that she had no cough at this time. The glands were so large, hard and discrete that Hodgkin's disease was considered but the microscopic examination of two of the glands showed them to be tuberculous. The intradermic tuberculin test was positive, leukocytes, 5,600. From the physical signs (Figs. 1 and 2) the diagnosis was made of enlarged bronchial glands, early involvement of right upper lobe—inner aspect

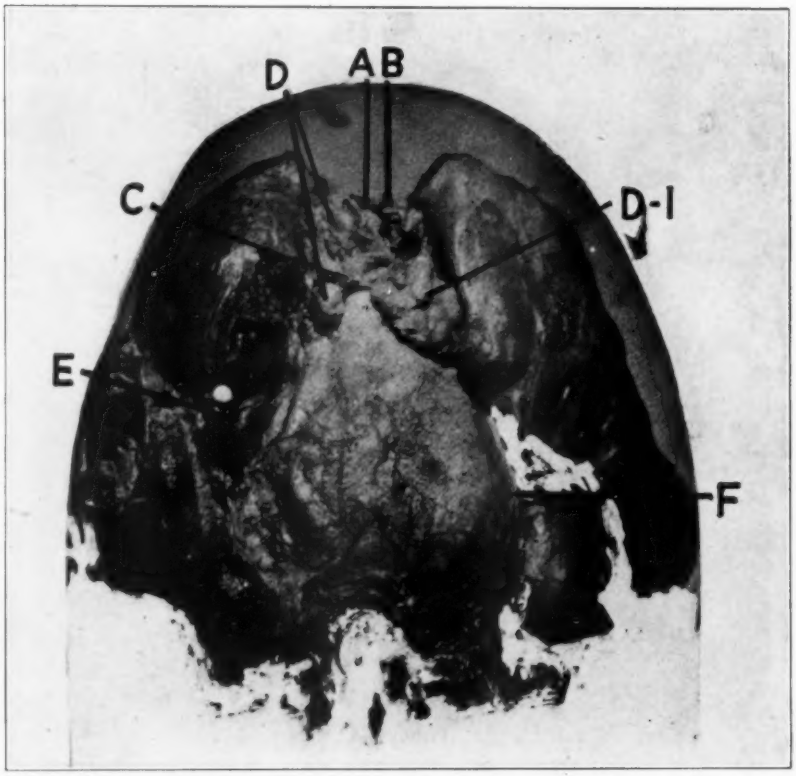


Fig. 3.—Thoracic viscera, anterior view; pericardium intact. *A*, trachea; *B*, left common carotid artery; *C*, junction of innominate veins; *D* and *D-1*, enlarged lymph glands; *E*, enlarged gland just beneath the pleura (lung held back by pin); *F*, left phrenic nerve. Just below the line from *C* the lung has been incised to show the advanced tuberculous process just above the right bronchus. The inter-position of glands *D* and *D-1* between the aorta and chest wall explain the accentuation of the aortic second sound.

—with either a thickened pleura or a slight effusion at the right base. The Roentgen ray, taken a few weeks later, shows extensive disease at the (Fig. 5, *c*) right root. This was the location of the most advanced lesion at the necropsy (note the lung under line *C*, Fig. 3). Because

of the peribronchial tuberculosis, tuberculin treatment seemed preferable to excision of the cervical glands.

After about six months of improvement, she gradually failed as the lesion in the right lung slowly advanced. At the time of her death, about eighteen months after first coming under observation, there was marked softening anteriorly below the right apex, inner half and above the inferior angle of the right scapula posteriorly.

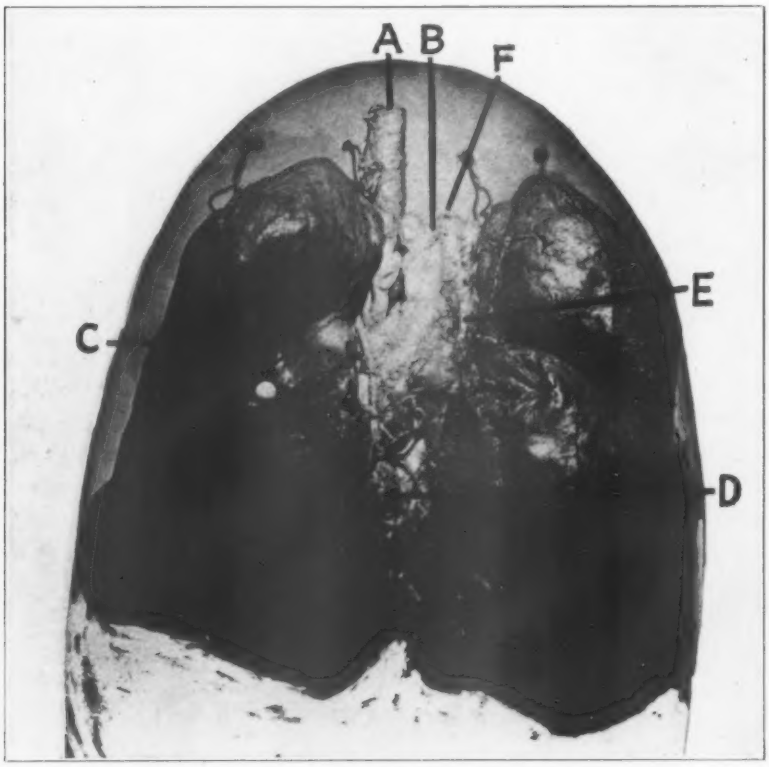


Fig. 4.—Posterior view thoracic contents. Aorta (*A*) has been dissected up in order to give a better exposure; *B*, trachea; *C*, very large gland between the lobes, just above the left bronchus. Internal to this gland the left vagus nerve is seen crossing the bronchus; *D*, the lower one of a chain of glands extending downward between the lower lobes; *E*, right vagus; *F*, right common carotid.

Throughout all the time the child was under observation, whispered bronchophony was present throughout the interscapular space and was always most marked to the left of the midthoracic vertebrae, and at the necropsy this area was directly over the enlarged gland between the left lobes. This fact, together with the diminishing of the whispered voice along the right side of the vertebrae, coincidental with the

development of the signs of pulmonary involvement, leads to the conclusion that it is the gland mass that plays the important part in the increase of the whispered voice.

It was never possible to elicit intrascapular dulness in the case of Helen A., until the signs of pulmonary involvement were evident. This probably was due in part to the fact that the largest gland posteriorly lay well to the left of the tracheal bifurcation about on a line with the vertebral border of the scapula. The impairment of the percussion note anteriorly was due to enlarged glands of the anterior mediastinum rather than to bronchial glands. Dulness anteriorly in children is usually due to an enlarged thymus, especially when most marked to the left.

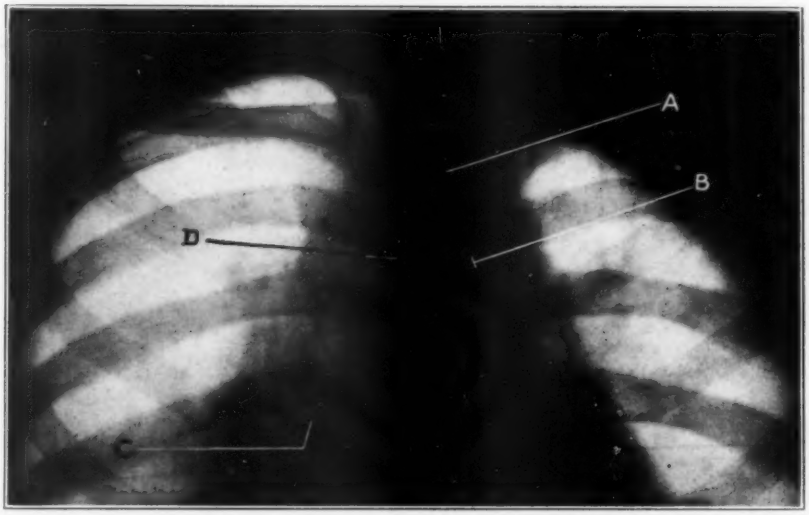


Fig. 5.—Roentgen ray of Helen A. (Case 1). Bifurcation trachea at *D*. Left border of treachea (*A*), left border of left bronchus (*B*). The extensive lesion at the right hilum is seen to the right of the heart whose right border is indicated by the inner end of line (*C*). Compare with physical signs and necropsy findings.

It should also be noted that the Roentgen ray did not reveal gland *C* (Fig. 4), as it lay behind the heart; hence a negative Roentgen-ray plate does not exclude glands along the left bronchus. She did not exhibit the inspiratory retraction ("hilum dimple") in the second and third interspace in the parasternal line which often is met with in children with peribronchial tuberculosis.

D'Espine's observations appear to have been made chiefly on infants and very young children. In older children and adults the bifurcation of the trachea is at a lower level than in the infant and for this reason the bronchophony is of questionable significance unless

heard down to or below the level of the fourth or fifth thoracic spine and its import is increased when heard at one or both sides of the vertebrae as well as over the spinous processes. It is very often present throughout the greater part of the interscapular space as is shown in Figure 2.

Its chief field of usefulness is in children in whom the tuberculous process is often limited to the tracheobronchial glands for months or years. It is also frequently of value in detecting peribronchial pathology in adults.

Several times this sign has been well marked in aged individuals with pulmonary tuberculosis in whom the usual signs were extremely indefinite.

As Hawes[16] 2d has recently expressed the opinion that this sign was of no value in this group it is perhaps worth while to refer to two of my cases that came to necropsy.

Fig. 6.—1, trachea; 2, left bronchus; 3, enlarged gland in angle between trachea and right bronchus.

The first was that of a woman of 66 who died of acute pericarditis and who had exhibited the D'Espine sign over the upper thoracic spine and slightly to the right. There was also some prolongation of the expiration at the right apex behind. At the necropsy no lesion of the apices was apparent but there was an enlarged gland just above the right bronchus (Fig. 6).

Another case was that of a woman of 64 whose history pointed to a tuberculous infection thirty years previously, during which time she had had occasionally slight activity. The signs of pulmonary involvement were indefinite, but the whispered bronchophony was always present throughout the interscapular space, being especially marked on the left.

16. Hawes 2d: Am. Jour. Med. Sc., 1915, cxlix, 664.

At the necropsy marked enlargement of the bronchial glands was found especially those above and below the left bronchus (Fig. 7).

Another interesting case was that of a young man who for a time was thought to have typhoid fever because he had a high temperature, a low leukocyte count and a positive Widal. Throughout his sickness he exhibited a marked D'Espine's sign, especially to the left where it extended nearly to the lower angle of the scapula. The large mass of glands about the bronchi and trachea is shown in Figure 8.

Fig. 7.—Posterior view; part of left upper lobe removed. Large bronchial glands above and below left bronchus.

D'Espine's sign is best elicited when the arms are folded well across the chest, the head sharply flexed and the patient sitting erect. Firm pressure should be made with the stethoscope as the patient repeats "three thirty three." When the sign is positive the final "e" of the last word persists for a moment like an echo after the phonation ceases. This postphonal quality is the significant feature. Young children can often be made to repeat the word "tree" more easily than the usual phrase. Occasionally the spoken voice or cough brings out the echoing quality more than the whisper.

The following case illustrates the importance of investigating the hilum region after the method described by D'Espine.

A number of years ago it was decided that a young man had a tuberculous infection because of marked asthenia, a slight afternoon rise of temperature and a very positive von Pirquet tuberculin test.

He was examined within a few months by four specialists on tuberculosis of national repute, in different parts of the country. One detected a slight limitation of motion at the left apex together with a questionable dulness and a very few inconstant râles in the outer third of the left supraclavicular space.

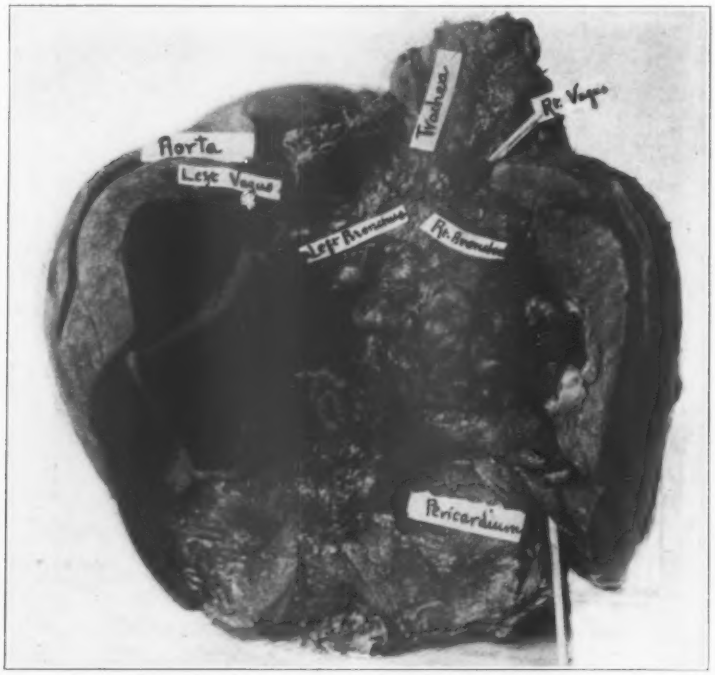


Fig. 8.—Posterior view made of lungs removed. Many glands above and below left bronchus, at the right root and along the right side of the trachea. Miliary tuberculosis of lungs.

A few months later the second expert found nothing but a few râles over the left lower lobe behind. Shortly thereafter a third specialist thought there was probably a healed lesion at the right apex though he did not believe the patient had any active tuberculosis. A few months later another man, the author of a well-known textbook on tuberculosis, found absolutely no trouble. As this was before the procedure described by D'Espine for detecting the presence of the enlarged bronchial glands, none of the men made a special study of the whispered voice in the hilum region posteriorly and no one expressed the opinion that the patient had peribronchial tuberculosis.

It was subsequently determined, however, that this patient had a very marked D'Espine sign, and roentgenograms demonstrated hilum disease and a few tubercles at both apices. The patient now presents bilateral retraction (hilum dimple) in the parasternal line of the third interspace.

SUMMARY

Whispered bronchophony in the interscapular space (D'Espine's sign) is indicative of a pathologic process at the hilum of the lung. This may be due to enlarged glands the result of malignancy, leukemia, Hodgkin's disease, syphilis or any infectious disease of the lungs. I have also seen it several times in aortic aneurism. Its presence in the delicate child is exceedingly suggestive of tuberculous involvement of the tracheobronchial glands.

Occasionally enlargement of the bronchial glands is present when there is no change in the whispered voice. In old people in whom the usual physical signs of pulmonary tuberculosis are sometimes exceedingly difficult to elicit the character of the whispered voice in the interscapular space should always be ascertained, as a well-marked D'Espine sign speaks for tuberculosis rather than for chronic bronchitis or emphysema.

The diagnosis of clinical tuberculosis, however, rests on the sum total of our physical signs and symptoms, not on one isolated sign.

I am indebted to Dr. Arthur J. Wolfe for the photographs of the patient in Case 1 (Figs. 2 and 3), which were taken in his laboratory.

75 Pratt Street.

THE LONGITUDINAL SINUS AS THE PLACE OF PREFERENCE IN INFANCY FOR INTRAVENOUS ASPIRATIONS AND INJECTIONS, INCLUDING TRANSFUSION *

HENRY F. HELMHOLZ, M.D.
CHICAGO

The more frequently it has become necessary to obtain sufficient blood from infants for various diagnostic purposes in recent years, the more evident is the fact that the various methods of obtaining it are unsatisfactory. The method of scarification gives tissue juice in addition to blood and is not applicable for bacteriologic work on account of the frequent contaminations. The method of obtaining blood from the veins of the scalp, from the jugular or other veins, is very difficult and open to frequent failures. This is especially true in some toxic conditions in which even the external jugular is not to be seen or palpated.

From the anatomic point of view there is one place that is far superior to any other for the purpose of obtaining blood, namely, the longitudinal sinus in the area of the anterior fontanel. Inasmuch as the sinus grows gradually larger toward the back of the head, it is advisable to attempt the puncture as far posteriorly as possible. The course of the sinus does not vary and it is readily located from the external landmarks. The vein, furthermore, is rigid, cannot be pushed aside, and on entering the sinus one gets just as definite a sensation of being within the lumen of the vessel as one does in piercing the dura in making a lumbar puncture. When one takes into consideration the fact that punctures of the ventricles can be done without any harm, the damage that might result from an occasional puncture of the brain substance is negligible. This method offers a sure, easy way of obtaining blood from an infant under any and all circumstances.

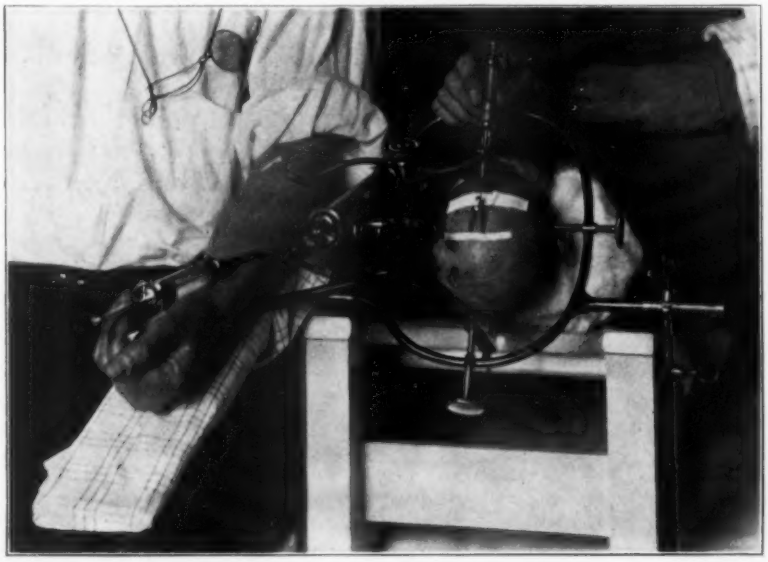
This does not exhaust the advantages of the sinus route. Just as readily as it lends itself to the obtaining of blood, can it be used for intravenous injection. Tobler[1] in a recent communication has pointed out the advantages of this method, which was first used by Marfan in 1898, for intravenous administration of salt solution. Tobler describes in detail the anatomy of the part and the technic of carrying out the puncture.

---

* From the Otho S. A. Sprague Memorial Institute Laboratory of the Children's Memorial Hospital.

1. Tobler, L.: Zur Technik der diagnostischen Blutentnahme und der intravenösen Injection beim Säugling, Monatschr. f. Kinderh., 1915, xiii, 384.

My interest in the sinus puncture arose principally from the fact that it offered a solution of the difficulties of transfusion during infancy. Vein to vein anastomosis, by suture or tube, is a surgical procedure that requires an expert and special apparatus. The failure of the syringe method of transfusion is dependent, even in the hands of an expert, on the difficulty of getting into the infant's vein either directly or after cutting down on the vein. This is especially true of cases of melena of the new born in which the external jugular may be completely collapsed when dissected out. By using the sinus route this difficulty is completely obviated and the method becomes just as easy if not easier than a vein to vein syringe transfusion of the adult.



The figure illustrates the apparatus as it has been worked out for transfusion. Tobler's communication, coming at a time when only a few transfusions had been done, helped a great deal to give the author confidence in the method.

The question of negative pressure within the sinus is one that cannot be overlooked, and it is well always in entering the sinus to have a syringe attached, and always before injecting anything to withdraw blood, to make sure that the needle is in the sinus. To simplify this procedure without changing any connections, the needle that is to enter the sinus is attached to a two-way stopcock, which at one outlet is connected with a record syringe, and at the other with the transfusion apparatus. When the needle is inserted the stopcock is turned so as to connect with the record syringe, into which, as soon as the needle enters the sinus, blood is drawn. This blood can then be used for

bacteriologic examination or returned into the sinus. The valve is then turned and the blood is expelled from the needle with the saline solution which fills the transfusion apparatus. The apparatus used in transfusion is the one described by Unger.[2] The advantage of this method is that there is a constant flow in both directions when blood is drawn into the syringe from the donor, saline is going into the vein of the recipient, and when the blood is being delivered to the vein of the recipient, saline is going into the vein of the donor.

In order to steady the needle in the sinus I have used the little holder shown in the figure, which is fastened to the head with adhesive in such a way that the needle when pushed through the metallic guide will enter the most posterior portion of the anterior fontanel in the midline. The guide has several screw clamps so that when the needle has entered the sinus these can be tightened. The guide is set at an angle of 25 degrees with the scalp.

In the figure is shown the head holder that has been used in holding the infant's head in position. This is not absolutely necessary, but makes the transfusion much easier. For long continued injections of saline solution it is especially useful.

104 South Michigan Avenue.

2. Unger, L. J.: A New Method of Syringe Transfusion, Jour. Am. Med. Assn., 1915, lxiv, 582.

FURTHER STUDIES ON THE EPIDEMIC ABORTION REACTIONS IN CHILDREN *

J. P. SEDGWICK, M.D.
Associate Professor in Charge of the Division of Pediatrics
AND
W. P. LARSON, M.D.
Assistant Professor of Bacteriology, University of Minnesota
MINNEAPOLIS

In a previous paper[1] we called attention to the fact that the blood serums of children consuming milk from cattle infected with contagious abortion often contain antibodies against *Bacillus abortus*.

Contagious abortion of cattle has been known to stockmen and dairymen the world over for the past century or more. There is probably no disease or combination of diseases which distresses the dairyman more or causes greater economic loss to him than this particular infection.

Up to the year 1896 the etiology of this disease remained obscure. In that year Dr. Bang[2] of Copenhagen isolated the organism which is now recognized as the specific etiologic agent in this disease. It is a short gram-negative, nonmotile bacillus which is somewhat difficult to isolate, but when once it has been grown successfully on artificial mediums its further cultivation presents few difficulties. The work of Bang shows that this bacillus is not only infectious for cattle, but for almost all of the domestic and laboratory animals. Ostertag found that it often caused abortion in mares.

In the domestic animals the site of infection appears to be in the uterine mucosa of pregnant animals. Until within the last two or three years the uterine mucosa was thought to be the only site of infection. Through the excellent work of Smith,[3] Fabyean,[4] Schroeder and Cotton[5] we know that the *Bacillus abortus* will affect laboratory animals and that abortion is not the only sign of infection. These authors have found that when a guinea-pig is inoculated intraperitoneally an infection occurs which cannot be differentiated macroscopically from tuberculosis. The spleen, especially, becomes very much enlarged and presents an appearance similar to that in an animal infected with tuberculosis. Not only the spleen and lymphatic system,

---

* Read before the Section on Diseases of Children at the Sixty-Sixth Annual Session of the American Medical Association, San Francisco, June, 1915.

1. Larson and Sedgwick: Am. Jour. Dis. Child., 1913, vi, 326.
2. Bang: Ztschr. f. Tiermed., 1897.
3. Smith and Fabyean: Centralbl. f. Bakt. Referate, 1908, lxi, 549.
4. Fabyean: Jour. Med. Research, 1912, xxi, 441.
5. Schroeder and Cotton: Bull. Bureau of Animal Industry, 1912.

but the bones, liver, and kidneys have likewise been found to be extensively involved.

We have had opportunity in the last two or three years to go over the work of Smith, Fabyean, Schroeder and Cotton and can confirm the work of these authors in every particular. Laboratory animals that become infected do not always abort. In fact, we have had animals which showed the lesions above described in very pronounced degree carry to term. It thus appears that the type of lesion produced by the *Bacillus abortus* depends entirely on the animal infected.

Owing to the prevalence of this disease among cattle, it would be logical to expect to find that this organism is widely disseminated in market milk. From the excellent work of the Bureau of Animal Industry we know that a very large percentage of market milk contains this organism.

Before the work of the authors above referred to was made public, the question had raised itself with us as to the possibility of children who consumed milk from infected herds being infected. In our first series of 425 children whose blood was tested to either or both agglutination and complement-fixation reactions, we found that 17 per cent. of our cases gave a positive reaction. The further interesting fact was observed that children known to be supplied with milk from a perfectly clean herd, that is, one which had never been affected with contagious abortion, did not give this reaction, while those fed on milk purchased on the market gave a high percentage of positive reactions.

We were able to show by specific absorption tests that we were dealing with true antibodies against the *Bacillus abortus,* as a positive serum could readily be rendered negative by depleting it of its antibodies by absorption with the *Bacillus abortus.* The significance of these findings we were not able to determine; whether the presence of these antibodies is the result of an infection of the child or the result of antibody absorption through the digestive tract, cannot at present be definitely decided. While there is no positive proof that the reactions are due to an infection of the child, we are inclined to accept this interpretation. While it has been shown that antibodies are excreted in milk and that these may be absorbed through the intestinal canal, it would hardly seem probable that these antibodies could be excreted in the milk and absorbed by the child through the intestinal tract in sufficient quantities to give a positive complement-fixation and agglutination reaction. Bang has shown that animals may become infected by the intestinal tract just as readily and almost with the same degree of certainty as when the organisms are injected subcutaneously or intravenously. If the same is true of human beings, it will be readily seen how anyone who consumes milk is amply exposed to infection.

As we mentioned in our earlier contribution, we have found that women who abort do at times give a complement-fixation reaction when the *Bacillus abortus* is used as an antigen. In the bloods of aborting women examined by Larson this reaction was even more common than the Wassermann reaction. We are indebted also to Dr. A. W. Robertson of Litchfield, Minn., for the report of two women who aborted during the time that there was an epidemic of abortion among the cattle on their farms. In these cases he was able to find no other causes by which he could explain the expulsion of the fetuses. Although these reports are not yet sufficient to form a basis for definite conclusion, they are certainly suggestive.

Although our earlier 425 cases showed that 17 per cent. of the children gave a positive fixation and agglutination test for the *Bacillus abortus,* the children in some groups gave a much higher proportion, in fact over 40 per cent. of the children in one institution gave positive reactions and one group gave as high as 48 per cent.

It appeared to us that the next step in attacking this problem was the determination as to whether new-born children, who had as yet received no cow's milk, give this reaction. In a series of new-born children at the Minnesota University Hospitals the blood was collected from the cord at birth, or from the child's heel during the first few days after birth, and immediately examined. In all, 42 such new-born children were examined, without a single positive reaction. Eighteen of the above forty-two children were girls. Three of the above infants died and postmortem examinations showed:

1. Baby H.: Bronchopneumonia with cardiac dilatation.
2. Baby N.: Congenital syphilis and bronchopneumonia. This child gave a positive Wassermann and a negative abortus reaction.
3. Baby K.: Bronchopneumonia and congenital hydronephrosis.

Baby boy Cl., who was not included in the above series, as he received other feeding than breast milk, is exceptionally interesting. His blood gave a positive reaction using the *Bacillus abortus* as antigen. He was taken from the breast on the seventh day after birth as he had a high fever, the cause of which was not ascertained. He was then fed on artificial food containing cow's milk and on the twenty-first day the reaction was positive. This is the earliest positive bacillus abortion reaction which we have observed, and it is especially to be noted that the reaction was found two weeks after removal from the breast. The child recovered.

As an enlarged spleen is one of the findings that is observed in laboratory animals which have been infected with the *Bacillus abortus,* we were especially on the lookout for positive reaction in children with clinically demonstrable enlargement of this viscus.

Baby B. gave a positive reaction and had an enlarged spleen. It was 19 months old, with fair nutrition and had been on a general diet. The postmortem examination showed empyema, abscess of the lung, suppurative coxitis and adenitis.

Gladys K., who had an enlarged spleen, gave a complete inhibition. She was 10 years old and fairly well nourished. She was on a general diet. Her previous illness had been tonsillitis and pertussis. She was in the hospital for epilepsy, but gave at times very marked spasmophilic reactions.

Baby B., 2 months old, with pneumonia and an enlarged spleen, gave a negative reaction.

Ger, a girl 18 months old, with rickets and an enlarged spleen, also gave a negative reaction.

As this reaction is carried out in the same manner as the Wassermann test except that the *Bacillus abortus* is used as an antigen, the fact that the blood of five children with congenital syphilis gave negative reactions with this test should be recorded.

As bone lesions suggestive of rickets have been produced in laboratory animals by injection of the *Bacillus abortus,* the fact that several marked cases of rickets gave negative reactions is of interest.

Other conditions in which negative reactions were found were eczema, hydrocephalus, nephritis, atrophy, varicella, measles, diphtheria, bronchopneumonia, chorea, enteritis, anemia, imbecility and chronic pulmonary tuberculosis.

SUMMARY

1. This further study confirms our earlier report of the finding of a deviation of complement in children with the use of the *Bacillus abortus* as antigen.

2. New-born children who have been fed at the breast *only,* do not show the reaction. One baby, 3 weeks old, after having been off the breast two weeks and on a food containing cow's milk, gave a positive reaction.

3. The finding of positive reactions in children with large spleens is suggestive.

4. The blood of children giving positive Wassermann reactions may show no deviation of complement when the *Bacillus abortus* is used as antigen.

5. Children with many of the common diseases of children, including rickets, gave negative reactions. Much further study is, however, necessary with such conditions.

6. For the practicing physician, the importance of breast feeding and the desirability of the heating of all cow's milk administered is emphasized.

THE RESULTS OF VON PIRQUET REACTIONS

MADE WITH OLD TUBERCULIN AND BOVINE TUBERCULIN ON THE CHILDREN OF THE STATE HOSPITAL FOR CRIPPLED AND DEFORMED CHILDREN AT ST. PAUL, TOGETHER WITH THE COMPLEMENT REACTIONS MADE ON THE BLOOD OF THE SAME CHILDREN WITH THE BACILLUS ABORTUS AS ANTIGEN

WALTER R. RAMSEY
Assistant Professor, Diseases of Children, University of Minnesota

There were in all 116 children examined, 58 boys and 58 girls. Von Pirquet reactions were made on all cases with old tuberculin and bovine tuberculin. Whenever a positive reaction was present for one, it was also present for the other. There were no exceptions to this rule.

Of the 58 boys, 20 reacted positive and 38 negative. Of the 58 girls, 22 reacted positive and 36 negative—a total of 42 positives and 74 negatives.

In 18 out of 20 positive reactions in boys, a clinical diagnosis of tuberculosis of the bone had been made. In the other two positive cases, one suffered from clubfoot and the other from infantile paralysis.

In 15 out of the 22 positive von Pirquet reactions in girls, the clinical diagnosis was tuberculosis of the bones or joints. Of the other 7 cases, one had clubfoot, 2 dislocated hips, 2 rickets, and 2 curvature of the spine.

Seventeen boys and 11 girls gave a negative von Pirquet when the clinical diagnosis was tuberculosis of the bone. Of the total number of 58 diagnosed clinically as tuberculosis, only 28 gave positive von Pirquet reactions.

COMPLEMENT-FIXATION REACTIONS WITH THE BACILLUS ABORTUS

Only 7 cases gave a positive complement reaction—6 boys and 1 girl.

Diagnoses: One ankle joint infection, von Pirquet negative.
One bow-legs, due to rickets, von Pirquet negative.
One tuberculosis of the hip joint, von Pirquet positive.
One tuberculosis of the hip, von Pirquet positive.
One old fracture of the tibia, von Pirquet negative.
One tuberculosis of the left hip, von Pirquet positive.
One curvature of the spine, von Pirquet negative.

All of the complement-fixation reactions were made by Dr. Larson of the Medical Department of the University of Minnesota, and most of the work in making the von Pirquets and in securing the blood was done by Dr. Giesler of the State Hospital for Crippled and Deformed Children.

DOES THE BACILLUS ABORTUS (BANG) INFECT MAN?*

MATTHIAS NICOLL, JR., M.D., AND JOSEPHINE S. PRATT
NEW YORK

The frequent presence in milk of *Bacillus abortus,* the causative agent of contagious abortion of cattle and its pathogenicity for, or at least its ability to cause abortion in, many species of animals, raises the question whether it may not be infectious for man. Mohler and Traum[1] tested the serum of forty-two persons by the agglutination and complement-fixation reaction with negative results. Fifty-six adenoids and tonsils from milk-consuming children were injected into guinea-pigs. The material from one case produced nodular areas in the liver, but cultures remained sterile. The injection of tonsils from another patient produced typical lesions in guinea-pigs and *B. abortus* was isolated. More recently Larson and Sedgwick[2] presented further evidence of the possible infection of man. They found that some women giving a history of abortion gave a positive complement-fixation reaction using *B. abortus* as antigen. They also examined the blood of 425 children, and 73, or 17 per cent., gave positive reactions. These results were checked by the agglutination reaction, which gave parallel results. The positive reactions were among children having bone lesions, mostly diagnosed as tuberculosis and rickets. As they point out, inoculation of cultures into guinea-pigs produces bone lesions, which may be epiphyseal enlargements, as well as lesions of the lymphatic nodes, spleen, liver, kidney, testicle and lungs.

As noted, the *B. abortus* has been isolated only once from human tissues. As this was a tonsil, the bacillus may have come from the milk ingested and is of no value as evidence of infection. The presence of serum reactions are suggestive, but they again are not conclusive, failing the isolation of the bacillus from the lesions. That the ingestion of bacilli in large doses may be followed by the presence of antibodies in the blood has been demonstrated by several investigators. We have had similar results in feeding guinea-pigs with typhoid bacilli.

Because of these findings of Larson and Sedgwick, we have tested a large number of serums, using the agglutination reaction. This method was selected as simpler to carry out and because of the con-

* Submitted for publication June 27, 1915.

* From the Division of Laboratories, Department of Health, New York.

1. Mohler and Traum: Bureau of Animal Industry, Circular 216, 1911.
2. Larson, W. P., and Sedgwick, J. P.: AM. JOUR. DIS. CHILD., 1913, vi, 326.

sensus of opinion that the agglutination reaction runs parallel with the complement-fixation reaction. Most of the cases have been infants or children who were inmates of a foundling asylum, and included cases of marasmus, rickets, enlarged lymph nodes, hypertrophied tonsils or adenoids, as well as about one hundred newly admitted infants from a few days to 2 months of age.

With few exceptions none of the serums from these infants had agglutinative power when tested in dilutions of 1 : 10 and 1 : 50. Two samples of serums from one child 3 years old, having bow legs and saber tibiae, undoubtedly rachitic, gave a good reaction as high as 1 : 100. The serums from two other children 2½ and 5 years old, respectively, with no noteworthy clinical abnormalities, gave slight reactions in the 1 : 10 dilution. The serum from another child, 3 years old, having enlarged tonsils and adenoids, gave a complete reaction at 1 : 200, the highest dilution tried. Swabs were taken from the tonsils of this child and the material injected into guinea-pigs. Later the tonsils were excised and after being ground up were also injected into guinea-pigs. These pigs developed no agglutinins for *B. abortus*, and were negative on necropsy, as were also cultures made from their organs. The serums from five other children with enlarged tonsils and adenoids gave a moderate or marked reaction in a dilution of 1 : 10 only. The tonsils were obtained but the guinea-pig inoculations were without result.

A case present in the obstetric ward of the above institution because of a seven months' miscarriage, but giving a negative Wassermann reaction, was investigated. The serum of the mother reacted up to 1 : 300, but became less active later, reacting only at 1 : 100 five months later. The serum of the child gave about the same reaction on one test. The foster-child of this woman was also tested with negative results. The vaginal discharge and milk from the mother and feces from the child were obtained and injected into guinea-pigs, with completely negative results.

The serums from twelve children having enlarged tonsils and adenoids were obtained at a dispensary. One gave a slight reaction at 1 : 10 dilution. The tonsils were ground up and injected into guinea-pigs without result. The serums from two other cases of miscarriage were also tested. In one case the only history obtained was of a seven months' miscarriage. The other patient had borne two dead children and more recently miscarried at four months. The Wassermann reaction was negative, but the patient was nephritic. Both serums gave no reaction even in low dilutions.

What interpretation one is justified in making from the above findings is doubtful. The serums from two children, one a child with enlarged tonsils, the other a case of miscarriage, gave unusually high reactions. Failing successful isolation of the *B. abortus,* such findings, as well as those reported by Larson, are only suggestive. We can at least say that no conclusive evidence has as yet been advanced that the *B. abortus* produces lesions in man.

QUANTITATIVE DETERMINATIONS OF NONPROTEIN NITROGEN IN THE BLOOD OF THE NEW-BORN *

FREDERIC W. SCHLUTZ, M.D.
Assistant Professor of Pediatrics, University of Minnesota,
AND
CHAUNCY J. V. PETTIBONE, PH.D.
Instructor in Physiological Chemistry, University of Minnesota,
MINNEAPOLIS

The nonprotein nitrogen fraction of the blood has for some time been the object of considerable study. This is due partly to the recognized intimate bearing it has on protein metabolism of the tissues, particularly the problem of the fate of protein digestion in the body, and partly due to the publication of methods which made possible a much more accurate determination of this fraction than was heretofore possible.

The studies and observations recorded so far are confined entirely to the blood of the human adult and of lower animals. To our knowledge, there is no reference in the literature on pediatrics to a study of the nonprotein fraction of nitrogen in the blood of the infant.

The quantitative determination of this fraction and some of its components in the newborn at various ages and at different periods of digestion, was the object of our study.

The difficulty in securing the blood from the living infant necessarily limited our observations to a study of the systemic blood only.

The total nitrogen, urea, ammonia and amino-acid nitrogen were determined quantitatively in a series of twenty-six infants varying in age from one half hour to 10 days old.

The source of the nonprotein nitrogen is almost entirely from the proteins ingested into the organism. There is considerable diversity of opinion as regards the fate of these protein digestive products in the body. Van Slyke and Meyer[1] have formulated the views held on this question at the present time under four hypotheses.

1. Ingested proteins are absorbed and incorporated into the body without undergoing any marked chemical change.

---

* Read before the Section on Diseases of Children at the Sixty-Sixth Annual Session of the American Medical Association, San Francisco, June, 1915.

* From the Minneapolis City Hospital and the Department of Medicine, Division of Pediatrics, University of Minnesota.

1. Van Slyke, D., and Meyer, G.: Jour. Biol. Chem., 1913-14, xvi, 197.

2. Food proteins are first hydrolyzed in the alimentary tract. The products of digestive hydrolysis are absorbed into the blood and carried to the tissues.

3. The products are deaminized in the walls of the intestine before entering the circulation.

4. The products are synthetized into serum proteins before entering the circulation.

While some of these hypotheses have at least in part been sustained by experimental proof, the work of Folin and Van Slyke and their co-workers, working with newer and much more accurate methods, has shown that these hypotheses are probably all more or less incorrect. Their results seem to indicate that the ingested proteins are completely hydrolyzed in the digestive tract. Most of their amino-acids are thus set free. These are absorbed into the blood stream unchanged and from there are taken up by the tissues.

Recent investigations in this field have brought out many interesting facts and have changed some of the prevailing views on protein metabolism.

The figures published by various observers on the amount of total nonprotein nitrogen (by this is meant the nitrogen not precipitated by methyl alcohol and zinc chlorid, Folin's method) in normal adult human blood, vary within wide limits. Partly this is due to the method used.

Schöndorf,[2] Strauss,[3] Rowntree and Fitz,[4] Holweg,[5] Widal and Ronchese[6] and Agnew[7] report maximum figures ranging between 50 and 70 mg. per 100 c.c. of blood.

Farr and Austin[8] and McLean and Snelling[9] found much lower values.

Folin and Denis[10] report a maximum of 22 mg. per 100 c.c. of blood. They found the nonprotein nitrogen in the portal blood at any given time higher than in the systemic venous blood. Urea nitrogen in the blood forms the largest percentage of the nonprotein nitrogen found there.

Many of the authors before mentioned quote figures between 50 and 70 per cent. In this case again the older methods give much higher

2. Schondörf: Pflüger's Arch., 1899, lxxix, 358.
3. Strauss: Die Chr. Nierenentzundigen, Berlin, 1902.
4. Rowntree and Fitz: Arch. Int. Med., 1913, xi, 258.
5. Hohlweg: Deutsch. Arch. f. klin. Med., 1911, civ, 216.
6. Widal and Ronchese: Compt. rend. Soc. de biol., 1906, lx, 245.
7. Agnew: Arch. Int. Med., 1914, xiii, 485.
8. Farr and Austin: Jour. Exper. Med., 1913, xviii, 228.
9. McLean and Snelling: Jour. Biol. Chem., 1914, xix, 36.
10. Folin and Denis: Jour. Biol. Chem., 1913, xiv, 29.

results. Folin and Denis[10] found between 11 and 13 mg. per 100 c.c. in human adult blood.

Recent investigation has shown some interesting facts in regard to the urea formation and distribution in the animal organism. Folin and Denis[11] found that urea formation was a characteristic of all the tissues, the greatest amount probably being formed in muscle, and that contrary to older conceptions, there was no specific organ for its formation. Folin believes that the amino-acids are in the end the essential source of urea. Marshall and Davis[12] and Fiske and Sumner[13] confirmed the work of Folin and Denis. They showed by direct experiment that urea could be formed from amino-acids even if the liver was cut out of the circulation.

The introduction of newer and more accurate methods showed the ammonia nitrogen fraction of the blood to be much smaller under both normal and abnormal conditions.

Folin and Denis[11] found that the portal blood contained more ammonia nitrogen than the systemic blood and that the amount of ammonia in the systemic blood under ordinary normal conditions was infinitesimal in amount. They were able to show also that the greater amount of the ammonia in portal blood is derived from the large intestine.

Recent publications have dealt largely with the amino-acid nitrogen in the blood. It is the most important fraction of nonprotein nitrogen.

Delaunay[14] working with the formol titration method of Sörensen[15] first demonstrated the presence of amino-acids in the blood of animals. The amount varied in different parts of the circulatory system, but was generally low in the systemic and high in the portal circulation. Preceding him, Van Slyke[16] had devised a very accurate gasometric method for the determination of amino-acids in fluids and tissues.

Van Slyke and Meyer[17] found that the blood of the fasting animal contained from 3 to 5 mg. of amino-acid nitrogen; also that introduction of amino-acids into the small intestine increased the amino-acid nitrogen of the blood of the mesenteric vein from 3.9 to 6.3 mg. per 100 c.c., and this increase affected the blood from the femoral artery almost as much as that taken directly from the mesenteric vein.

---

11. Folin and Denis: Jour. Biol. Chem., 1912, xii, 141.
12. Marshall and Davis: Jour. Biol. Chem., 1914, xviii, 53.
13. Fiske and Sumner: Jour. Biol. Chem., 1914, xviii, 285.
14. Delaunay, H.: Contrib. à l'étude du rôle des acides aminés dans l'organisme animal Thèse de Bordeaux, 1910.
15. Sörensen: Biochem. Ztschr., 1908, vii, 45.
16. Van Slyke: Proc. Soc. Exper. Biol. and Med., 1909, xii, 46.
17. Van Slyke and Meyer: Jour. Biol. Chem., 1912, xii, 399.

Abderhalden and Lampé,[18] using the ninhydrin color reaction, detected amino-acid nitrogen in the blood and confirmed the results of Van Slyke and Meyer.

Dobrowolskaja[19] found an increase in amino-acid nitrogen in both portal and peripheral systemic blood during digestion. Costantino[20] published similar results.

Wolkow[21] found only a slight increase in the peripheral blood, generally about 4 mg. to 100 c.c. of blood. The experiments of Van Slyke and Meyer proved conclusively that amino-acids normally pass the intestinal wall unchanged and enter the blood-stream directly, thus controverting a theory advanced by Abderhalden[22] that they are synthetized into blood proteins while passing the intestinal wall and are only broken down again to amino-acids when they reach the tissues.

In the series of cases we are reporting all the determinations are only on systemic venous blood. From 15 to 20 c.c. of the blood were taken under aseptic precautions from the median basilic vein of the arm and at once taken to the laboratory for the determinations.

In four of the cases the infants had not yet been fed; in one of these cases the blood was taken one-half hour after birth. In the other cases the period after feeding at which the blood was taken varied between one-half and four hours.

The ammonia determinations were generally completed within less than one hour after taking the blood.

Total nitrogen, urea and ammonia were determined according to the micromethods devised by Folin and Denis.[23] In a part of the series, the urease method recently published by Van Slyke and Cullen[24] was used. The amino-acid nitrogen was determined according to the gasometric method of Van Slyke and Meyer.[25] Five cubic centimeters of blood were used for all the individual determinations except those done with the urease method. In these 3 c.c. of blood were used. A few of the amino-acid determinations were carried out on 2 c.c. of blood (Cases 1 and 2). The urea and total nitrogen were determined together in the same specimen of 5 c.c. In this determination the blood was precipitated with methyl alcohol and the filtrate again with zinc chlorid. The slight modification recommended by Bock and Benedict[26] of distilling off the ammonia instead of driving it over with

18. Abderhalden and Lampé: Ztschr. f. physiol. Chem., 1912, lxxxi, 473.
19. Dobrowolskaja: Ztschr. f. physiol. Chem., 1913, lxxxvii, 325.
20. Costatino: Biochem. Ztschr., 1913, lv, 402.
21. Wolkow: Ztschr. f. physiol. Chem., 1913, lxxxvii, 334.
22. Abderhalden: Synthese der Zellbausteine, 1912.
23. Folin and Denis: Jour. Biol. Chem., 1912, xi, 527.
24. Van Slyke and Cullen: Jour. Biol. Chem., 1914, xix, 211.
25. Van Slyke and Meyer: Jour. Biol. Chem., 1912, xii, 402.
26. Bock and Benedict: Jour. Biol. Chem., 1915, xx, 41.

TABLE SHOWING NONPROTEIN NITROGEN DETERMINATIONS

Case Number	Infant's Weight gm.	Age of Child	Hours After Feeding	Total Non-Protein Nitrogen	Urea Nitrogen, Folin-Denis	Urea Nitrogen, Van Slyke	Urea Nitrogen, Per Cent.	Ammonia Nitrogen	Amino-Acid Nitrogen, Van Slyke
1	3,120	2 days	3	.....	.....	.....	....	.....	0.001
2	2,980	4 days	4	.....	.....	.....	....	.....	0.001
3	2,850	5 days	4	0.023	0.014	.....	60.8	0.0005	0.0004
4	3,000	3 days	2	0.044	0.014	.....	31.8	0.0006	0.002
5	2,945	2 days	3½	0.032	0.012	.....	37.5	.....	0.006
6	2,580	8 days	2	0.024	0.008	.....	33.3	.....	.....
7	2,165	10 days	2½	0.023	0.015	.....	43.4	.....	0.005
8	3,200	2 days	1½	0.037	0.024	.....	64.8	0.0004	0.003
9	3,550	9 days	½	.....	.....	.....	....	.....	0.003
10	2,800	2 days	½	.....	.....	.....	....	.....	0.003
11	3,280	12 hours	1½	0.032	0.018	.....	56.2	0.0003	0.005
12	2,860	2 days	4	.....	.....	.....	....	0.0003	0.003
13	3,395	9 hours	Not fed	.....	.....	.....	....	.....	0.003
14	3,325	4 days	3	.....	.....	.....	....	0.0003	0.005
15	2,650	8 days	3	.....	.....	.....	....	0.0003	0.003
16	2,640	8 hours	Not fed	0.040	0.016	.....	41.5	0.0003	.....
17	3,690	8 days	3½	.....	.....	.....	....	0.0002	0.0003
18	3,450	3 days	4	.....	0.020	0.021	....	0.0003	0.002
19	3,620	13 hours	3	.....	.....	0.016	....	0.0002	.....
20	3,225	1 hour	Not fed	.....	.....	0.006	....	.....	0.003
21	3,760	½ hour	Not fed	0.023	.....	0.004	17.3	0.0002	0.001
22	3,800	2 days	½	.....	.....	0.015	....	0.0002	.....
23	3,350	6 days	1	.....	.....	0.005	....	.....	.....
24	3,715	12 days	1	.....	.....	0.006	....	0.0004	.....
25	3,400	8 days	3½	.....	.....	0.013	....	0.0003	.....
26	3,900	20 hours	4	.....	.....	0.009	....	0.0003	0.002

an air current was used in both total nitrogen and urea determinations. In the urea determinations with the urease method, ammonia and urea are combined.

Van Slyke found the ammonia fraction so small, if the blood is used within one hour, that it can be disregarded. The urea determinations with Folin's method and the urease method of Van Slyke check closely. In the amino-acid determinations the blood was precipitated with ethyl alcohol and allowed to stand for twenty-four hours. A review of our different results shows that the total nonprotein nitrogen per 100 c.c. of infant's systemic blood is approximately the same as in the adult. The age and weight of the infant and the period after feeding have no bearing.

The percentage of urea nitrogen is uniformly high and averages about 50 per cent. of the total nitrogen. It was lowest in the new-born infant one-half hour old, and in the infants which had not been fed.

The amount of ammonia nitrogen is extremely small in every instance and is also not influenced by the age of the infant or time after feeding. Probably the most interesting fact brought out is that amino-acids are constantly present in appreciable amounts in the infant's blood and were found present shortly after birth when no feeding had as yet been given. In this connection the work of Koelker and Slemmons[27] is interesting, possibly explaining the probable source of the amino-acid in the blood of the infant just born or before the first feeding. These authors isolated twelve different amino-acids from placental blood.

In the case of amino-acids again, the time of feeding apparently has no appreciable effect on the amount of amino-acids present in the systemic blood of the infant.

It can hardly be said that the changes in the nonprotein nitrogen in the systemic blood reflect the stages of protein digestion. It should be borne in mind that in this series no attempt was made to correlate the amount of food taken with the amounts of the various factors determined.

Further experiments bearing on this particular problem and also on the nonprotein nitrogen content of placental blood, are in progress.

27. Koelker and Stemmons: Jour. Biol. Chem., 1911, ix, 471.

PROGRESS IN PEDIATRICS

RECENT PROGRESS IN INFANT WELFARE WORK*

PHILIP VAN INGEN, M.D.
NEW YORK

During the past year, in spite of unfavorable conditions, financial and political, infant welfare work has steadily increased in extent and efficiency. Even from war-cursed Europe a few reports of progress have been received.

PUBLIC ACTIVITIES

The federal Children's Bureau has been very active in investigating various phases of infant welfare work. Two most excellent studies in the field of infant mortality have been made in Johnstown, Pa.,[1] and Montclair, N. J.[2] Carefully collected data concerning the relation of sanitation, housing conditions, literacy, race, employment of women, attendance at confinement, method of feeding, etc., to infant mortality are well presented. While the localities studied are small, and the tabulations are based on too few cases to be conclusive when taken alone, when all these studies are completed they will form a most valuable addition to our knowledge of these subjects.

The Bureau has sent out to health officers of cities of 10,000 population and over and private organizations a carefully prepared list of questions concerning their activities, and when the answers have been compiled they will give most valuable information for those interested in this subject. The author was freely permitted to study these reports and much of the information given below was obtained therefrom.

During the past year the Kansas State Department of Health has organized a division of child hygiene, so that New York is no longer the only state with such a division. Steps are being taken toward the organization of a similar division in Ohio, and Louisiana and Massachusetts have well defined branches of the State departments of health giving attention to the subject. The majority of the states are now more or less actively engaged in infant welfare work. At least sixteen have exhibits on the subject. Louisiana and Texas have fitted up exhibit cars which travel all over the state. In twenty-two lectures

* Submitted for publication July 6, 1915.

1. Infant Mortality. Results of a Field Study in Johnstown, Pa., Based on Births in One Calendar Year. Bureau Publication No. 9, Washington, 1915.

2. Infant Mortality. Montclair, N. J. A Study of Infant Mortality in a Suburban Community. Bureau Publication No. 11. Washington, 1915.

are given as part of the regular activities of the department. Twenty-three states issue special bulletins or booklets on the care of the baby, which are widely distributed, in some cases one being sent to the mother of every baby whose birth is registered. The public press is used in spreading information by fourteen states.[3]

Probably the most extensive campaign carried on was in New York. As a preliminary a letter was sent out by the Commissioner of Health to all health officers in the state asking for their cooperation, and for information as to the needs in their particular localities. The objects of the campaign were, "to educate the mother in the care and feeding of her child, to arouse the community to the necessity for child welfare work, to point out the fact that a high infant mortality was unnecessary and should be considered a disgrace, to establish infant welfare centers with the employment of nurses, and to improve the general milk supply." Three special exhibits were prepared and those of the Rochester department of health and the Russell Sage Foundation were borrowed. During April, May and June these exhibits were shown in forty-five cities and large villages, over 150 public meetings had been held in connection with them and over 79,000 people had been reached. Three additional exhibits were prepared dealing especially with rural hygiene and, with the other exhibits, were shown during August and September at fifty-five county fairs, the State Fair, and the Rochester Industrial Exhibition. Ten requests for them had to be refused.

All exhibits were in charge of a trained nurse or specially trained person. Advice and literature were given, and, in addition, special meetings were held for mothers and prospective mothers. The older girls in the public and parochial schools were given talks and demonstrations, and, when requested, the nurse did a certain amount of home instructive visiting. In certain places two moving picture films were used in connection with the exhibit, on the care of the baby and on the subject of pure milk.

Wherever the exhibits were shown an attempt was made to arouse public interest and to try to secure the establishment of infant welfare stations. In 1913 there were thirty-two such stations in twelve localities outside of New York City. As a result of this campaign, by the end of 1914 there were sixty-seven stations already established in thirty-two different localities.

This was only a part of the activities of the department. Among others may be mentioned a campaign to establish a state organization of "Little Mothers' League," sending its pamphlet "How to Save the Babies" to the mother of every baby whose birth was registered, with

3. Information obtained from the Children's Bureau.

a letter from the commissioner, and within the last few weeks the organization of a State-wide Baby Welfare Sunday.

How much good is accomplished by the distribution of literature is still something of an open question. That it does have some effect and is appreciated is shown from the following letters.

Locust Valley, N. Y., Dec. 21, 1914.

New York State Department of Health, Albany, N. Y.

Gentlemen:—A few days ago my wife received from you the "Baby Book." We cannot begin to express our gratitude to you for this little book. It is a Godsend to any mother with a little baby. It is being the means of saving thousands of lives and untold hours of care and worry.

I have two sisters. One has a baby several months old, and the other will be a mother this coming spring. If it is not asking too much, I would like two more baby books — one for each of these women.

Thanking you again, I remain

Yours very truly,

Yonkers, N. Y., Dec. 5, 1914.

Dear Sir:—Recently one of my young mothers received a pamphlet from you, the title of which, I believe, was "Your Baby — How to Keep It Well." I would like to ask if each mother is to get one? I was much pleased with the pamphlet and would like one myself.

Yours sincerely,

Dr. ———————————

P. S. It seems to me that if the doctors, nurses and midwives were included in the distribution of the pamphlet it would be of value.

The report of the Division of Child Hygiene of the New York State Department of Health will soon be published, and is worth careful study. The infant mortality rate in the state, outside of New York City, fell from 125 in 1913 to 111 in 1914.

The activities of city departments of health have also increased very much in scope. Ninety-nine state that they are doing instructive work among mothers through visiting nurses; thirty-seven that they are maintaining welfare stations; and thirty-eight that they are doing pre-natal work.

INFANT WELFARE STATIONS

A year ago I was able to report the existence of 204 such welfare stations in thirty-nine cities and towns. The Federal Children's Bureau this year have secured data concerning 462, of which 290 are maintained by private organizations in ninety-two cities.[3]

A very interesting bit of evidence as to the value of these welfare stations is contained in a communication from Miss Jean Halford, secretary of the British National Association for the Prevention of Infant Mortality. She says:

The war has helped to arouse the conscience of the nation, as perhaps nothing else would have aroused it, to a sense of the supreme importance and value of healthy motherhood and infancy, with the result that more new infant wel-

fare centers have been established since the outbreak of hostilities than ever before in so short a time. Much of this development has, however, been due to the work of eight organizers appointed by the Association of Infant Consultations and Schools for Mothers. . . . So great was the enthusiasm aroused in this way that new centers were formed and are still being formed at the rate of four or five every week, sometimes holding the first infant consultation within a fortnight of the visit of an organizer. The consequence is that during the first eight months of the war over 100 new schools for mothers, many of which included dining rooms for nursing and expectant mothers, were actually started, while some 200 more will shortly be ready to open. . . . So far only towns with a population of 20,000 or more have been tackled.

The English government now grants to these stations funds from the public treasury up to 50 per cent. of the approved expenses. This in spite of the tremendous drain on the financial resources of the Empire.

The effort is being made in several places in this country, notably New York, Philadelphia, and, more recently, Buffalo, to develop the infant welfare station to its highest degree of efficiency. In New York this work is being carried on by the New York Milk Committee and is the development of the experiments and demonstrations of the value, first, of the milk station in reducing infant mortality—especially that due to diarrheal disease—and, later, of the mortality due to still-births, congenital debility, prematurity, etc. The work is being done in one of the most neglected and insanitary districts in the city and the effort is being made to make the "Health Center" the central point for all the health protective activities in this district. The safeguarding of the public health, whether of babies or adults, after the first broad general principles have been established, must be in large part a local matter. This is especially true in our large cities, notably those near the coast. Where many nationalities are represented there is a tendency for them to segregate and the problems arising differ very materially for these different groups of people. At the Health Center the effort is made to get in touch with every family in the district in which the center is located and to make it the natural headquarters for all matters pertaining to the health and welfare of the entire family, especial effort and attention being given to the children. Infant consultations are held every afternoon; the nurses make home visits of instruction and supervision; thorough prenatal instruction is given, and the nurse acts as advisor and friend in all questions directly or remotely connected with the health of the family. The most complete and cordial cooperation exists between the Health Center and the various city departments having charge of street cleaning, tenement houses, fire protection, police and health administration, as well as all other organizations in any way doing any form of work for the betterment of living conditions in this district. This work was started nearly two years ago and since that time has been taken up

along very similar lines in Philadelphia and, within the last few months, also in Buffalo.

REDUCTION OF INFANT MORTALITY DURING THE FIRST WEEKS OF LIFE

No form of infant welfare work has appealed so strongly as that directed toward saving the lives of babies by trying to secure to them a fair start in life. It is very difficult to estimate the results of this work at present, owing to differences in methods employed, and the varying ways of tabulating statistics. It is also possible that several of the organizations claiming to be doing prenatal work are doing it in a very casual and haphazard way. So far as is known, however, thirty-eight city health departments and 247 private agencies are doing this kind of work in 110 different localities.[3] In St. Louis, the Children's Hospital and the obstetric department of Washington University are carrying out a well organized work for babies, beginning from the day the mother reports to the obstetrics clinic and continuing until the baby is 1 year old. A report on their prenatal work has already been published. A further report is in preparation, dealing with the results of their work through the first year of the baby's life.

In New York City, the Department of Health has carried on this work in connection with its milk stations. An attempt has been made for two years to secure special funds from the city to provide an adequate nursing force to do intensive work along these lines, but, owing to the financial situation, it was unable to obtain them. During the year 1914, 1,622 mothers were registered. Of these 898 women had been confined and at the end of the year 409 were still under observation. There were 900 births among these 898 women, with a stillbirth rate of 34.4 per 1,000 births and a death rate among the babies under 1 month of age, based on living births, of 19.5 per 1,000. Over 90 per cent. of the babies living at the end of the first year were being breast fed.

INSTITUTIONAL MORTALITY, THE ILLEGITIMATE BABY

During the past year increasing attention has been given to the problem of the mortality among so-called foundling institutions. Receiving, as they do, great numbers of illegitimate babies, whose start in life is always an unfavorable one, the mortality in these institutions has been known for years to be high. Unfortunately it has been regarded as more or less inevitable and little attention has been paid to the subject. The American Association for Study and Prevention of Infant Mortality, through their Committees on Pediatrics and Social and Vital Statistics, undertook a preliminary study of this subject. Every child admitted to the three large institutions in New

York City receiving foundlings, abandoned or neglected babies, was traced through its first year, or up to the time of its death during its first year. The report of this committee[4] contains some startling facts. It was found that of 1,738 babies, 51.61 per cent. died under 1 year of age. Most of them were admitted to the institutions without their mothers and no less than 50.1 per cent. were deliberately abandoned by their mothers at the institutions. Of those whose mothers remained with them and nursed them for a time at least, the mortality was only 27.11 per cent. as against a mortality of 51.61 per cent. for all the babies admitted. It was found that 22 per cent. died within less than one month, and nearly 35 per cent. in less than two months after admission. While this would seem to bear out the claim so often made that the death rate is high on accouint of the bad physical condition of the baby, the fact that of 209 babies who were born in the institution and whose mothers had been under careful supervision for several months before the birth of the baby, only 7 per cent. died during their first month and 20 per cent. in less than two months, yet before the first year was over 48 per cent. had died, suggests forcibly the need of more careful study of the problem of the effect of institutional environment.

The New York City Department of Charities has already undertaken an investigation of the institutions caring for its youthful charges and has found that the conditions existing in many of them are medieval. These conditions were summarized in a recent paper by the Second Deputy Commissioner.[5]

An effort has been made in New York City, through cooperation between the New York Foundling Hospital, the City Department of Health and the Russell Sage Foundation, to reduce the mortality among "marasmus babies" in these institutions. It is generally admitted by those familiar with the subject that from 75 to 100 per cent. of these babies in institutions die. In this investigation marasmus babies were placed out with foster mothers specially selected for their intelligence, and a bonus of five dollars a month was given to them for special care. They were under constant supervision of the nurses and inspectors of the Department of Health, were required to be taken regularly to the nearest welfare station, and everything was done to insure their having the best chance possible. It is stated that the "results of this experiment have been most encouraging, not only as far as life saving is concerned, but particularly with regard to the restoration to complete health of the babies cared for. Up to the

4. Mortality in So-Called Foundling Institutions. Trans. Fifth Ann. Meeting Am. Assn. for Study and Prev. Infant Mortality, Baltimore, 1914.

5. A Study of Results of Institutional Care. Hon William J. Doherty, National Conference Charities and Correction, Baltimore, 1915.

present time, the reduction in the death rate among these infants has been about 50 per cent."[6]

In Europe the problem of the illegitimate baby has become a very acute one. Belgium and portions of France which have been overrun by invading armies have one phase in its most distressing form, while all the countries of Europe where enormous armies are gathered have another phase to consider. In France the subject of the "war baby" has been squarely met by the authorities. It is said:

> . . . The object of these emergency measures is not only to avert unnecessary suffering from the victims of brutality and license, but to save the lives of the children about to be born by removing the temptation to infanticide. To this end the customary formalities and inquiries so dear to the official mind — so particularly dear to the French official mind — are for the time being relaxed and practically waived; in place of the usual precautions and deterrents every effort is to be made to induce the woman who has been a victim of war at its foulest to claim the protection of the state for herself and her unborn child.
>
> Hence it has been enacted that in any commune which has been occupied by German troops the simple certificate of a doctor — sent straight to the local prefect and not handled by subordinate officials — will give the woman to whose condition the doctor has testified a claim on public assistance and entitle her to a gratuitous treatment and the payment of necessary expenses. Further, should any woman prefer to conceal her misfortune, not only from her neighbors, but from the local doctor and the local prefect, a maternity hospital in Paris will be open to her without any other credential or formality than the proof of her residence in a part of the country which has been occupied by the German army.
>
> The mother, of course, is only half the problem; when you have made provision for her in her hour of need, provision for the actual birth of her child, there still remains the question of the fate of the child so born. Here, again, the state has flung its caution and precaution to the winds and assumed the full responsibility, and by so doing has recognized the right of the woman to be relieved of a burden forced on her. Unless it is otherwise desired by the mother, the child from the day of its birth will be treated as an orphan and a foundling; whatever its birthplace, it will be sent to Paris and duly registered, not in the archives of the commune in which it was born, but from the Paris institution in which it will be tended and reared. By this means its identity will be concealed, all traces of its origin lost, and the knowledge of its parentage hidden from itself as well as from the outside world; it will grow up among other fatherless and motherless children, unconscious of the sin that gave it life and of the alien blood which would be an added stain on its birth.

In England, which has not been overrun by the invaders, but which has been turned into a great training camp, the problem is different, but it is no less of a problem. Committees have been formed to investigate the extent of illegitimacy, and the matter has been taken up in the House of Commons.

---

6. Personal letter from Dr. S. Josephine Baker, Chief Division of Child Hygiene, New York City Department of Health.

PREVENTION OF DIARRHEAL DISEASE

Fly Prevention.—During the last few years, the common house fly has come in for considerable attention as to its relation to diarrheal disease among babies. An extensive study has been carried out by the New York Association for Improving the Condition of the Poor with the assistance of the health department. Preliminary reports on their work have already been presented and the detailed report is about to go to the press. The investigation was carried out under the most carefully considered conditions and with very thorough supervision. The results obtained are, to say the least, very suggestive. In a certain locality in the city, after a careful census of the families living in tenement conditions, half were selected to receive all advice, supervision and care which could be given, except vigorous measures to protect from flies. The other half, in addition to the same general measures, agreed to follow out instructions looking directly to the protection of the child and its food from exposure to flies. The results of this, as shown by the prevalence of diarrheal disease in the two groups, is interesting. Nearly twice as many babies suffered from diarrhea during the period of the experiment among the unprotected group as among the protected. This was true to a less degree when the other phases concerned were considered, such as general cleanliness in the home, type of feeding, intelligence of the mother, etc.

In Richmond, Virginia, for the last two years, the Chief Health Officer, Dr. Levy, has instructed his infant welfare nurses to lay particular stress in their home visits on the necessity of immediate care of the stools of babies so that the risk of contamination of food, etc., by means of flies may be reduced to the minimum. Dr. Levy is convinced that this plan, carefully carried out, has had a great deal to do with the marked reduction of the diarrheal mortality in Richmond during the past two years.

EFFORTS AT CO-OPERATION

The necessity for cooperation among all agencies working toward the saving of child life is becoming more and more appreciated every day. In Philadelphia a baby welfare association, working along the general lines adopted by an older organization in New York, has been formed. In both places the association acts as a clearing house for information and has an agency to secure prompt action in emergency. The motto of the New York organization, "To Save Babies by Saving Wasted Effort," explains its purpose. As an example of how such organizations can work may be mentioned one or two examples. In milk station work the great difficulty encountered by all has been to secure the attendance of mothers with their babies within the first

month after the birth of the baby. By an arrangement which has been perfected in New York, as soon as a mother and baby are discharged from a maternity hospital, the name and address and date of discharge are forwarded to the Babies' Welfare Association, which communicates with the nearest milk station, referring the child to it, and the mother is then visited by the nurse from the station and urged to enroll. During one month over three hundred cases were so referred by the maternity hospital.

In the promotion of breast feeding for babies, the association has made an arrangement whereby as soon as the death of a baby under 9 months is reported to the health department, the name of the mother is immediately sent to the association for investigation and the mother is asked whether she would be willing to wetnurse a baby in her own home or to go out as a wetnurse. By placing this information in the hands of institutions and physicians, it is hoped that much of the almost criminal separation of the wetnurse from her own baby and the unnecessary waste of wet nursing material may be prevented.

As a further evidence of the cooperation which is gradually springing up, in eight cities it is known that health departments and private organizations are jointly maintaining instructive visiting nursing, milk stations and prenatal work.

GENERAL EDUCATIONAL EFFORTS

The need of teaching girls in the upper grades of public schools the principles of personal hygiene and the elements of baby care, is every day becoming more clearly appreciated. For a number of years in England, the Board of Education has urged local authorities to include courses covering these subjects and has made detailed recommendations as to the way such instructions should be given. More and more in England are the public schools adopting the plan. In one school this course covers three years and includes all that is implied in "home making." A part of it includes practical instruction in bathing, dressing, and the general care of a baby, kind of clothing it needs, care of the bottles and the dangers of various superstitions and customs. In another school, in the last year the older girls are attached to home-making centers. Half of each day is devoted to practical work in home making. During several weeks the school room is converted into a nursery and they are taught how to look after children. In another school in London, part of the instruction consists of six weeks of practical work in a day nursery, under special instruction and supervision.

In Cleveland, during 1911 and 1912, the Babies' Dispensary demonstrated the feasibility and importance of teaching infant hygiene to the

girls of the public schools there. As a result, such teaching has gradually been incorporated into the regular curriculum of the schools so that, this year, every girl in a public school will get this course as part of her compulsory work before she graduates.

As has already been mentioned, the Department of Health in New York State, in cooperation with the Department of Education, is carrying on an extensive campaign for the formation of "Little Mothers' Leagues" in the public schools throughout the state.

During the summer of 1914 a very extensive campaign of education was carried out in New York City through holding a "Baby Week." The mayor of the city issued the call. Practically every organization in the city was called upon to take part in carrying out the program and all responded willingly. A letter was sent by the mayor, which was read in many of the churches and synagogues throughout the city. A similar letter was read to the children of every public school on the Monday of "Baby Week," followed by appropriate ceremonies in many of the schools. The rest of the week was given up to demonstrating the needs of the babies of the city and the work that was being done to meet those needs. The milk stations, day nurseries, hospitals, outing associations and other activities all came in for their share of attention. During the week the final baby contest was held, at which was selected the prize baby of the city. Previous contests had been held during the winter and spring and the winners of all these preliminary contests competed. The final ceremony was a parade of milk station babies with their mothers in Fifth Avenue motor busses, private automobiles and taxicabs, all of which were donated for the occasion, which parade was reviewed by the mayor, commissioner of health and other city officials and the prize baby and the winners of other prizes were presented by the mayor with their diplomas, after which the children and their mothers were given a ride through the park. There was a tremendous response from every side to this plan for stimulating interest. Department stores held special baby week sales. The newspapers gave much space to a description of the proceedings. The advertising companies donated space on their bill boards. The results of such a campaign is hard to judge, but from the requests for information received from all over the country, it may be said that "Baby Week" was a success in calling attention to the needs of the baby. Similar work has been carried on since in a number of other places and during the first week of July, a local "Baby Week" is to be celebrated in the Borough of Richmond, New York.

CURRENT PEDIATRIC LITERATURE

ANATOMY AND PHYSIOLOGY

Bronchial Glands, Studies in.—W. W. Howell.
Am. Jour. Dis. Child., August, 1915.

Cerebrospinal Fluid, Measurement of Pressure of.—S. Indelicato.
Gazz. d. osp., June 10, 1915.

Children's Blood, Lipase Content of.—V. Zamorani.
Pediatria, June, 1915.

Growth and Reproduction, Influence of Composition and Amount of Mineral Content of Ration on.—E. V. McCollum and M. Davis.
Jour. Biol. Chem., July, 1915.

Infants' Stools, Ammonia and Urea Content of.—J. L. Gamble.
Am. Jour. Dis. Child., June, 1915.

Measurements, Some, of Normal Children Especially of Leg and Arm.—J. I. Grover.
Arch. Pediat., June, 1915.

Stomach, Tonus and Hunger Contractions of, of Newborn. Physiology of Stomach.—A. J. Carlson and H. Ginsburg.
Am. Jour. Physiol., July, 1915.

Stools of Infants, Forms of Nitrogen in.—D. D. Van Slyke, A. M. Courtney and H. L. Fales.
Am. Jour. Dis. Child., June, 1915.

Stools, Practical Importance of Examination of, in Infants.—H. M. McClanahan and J. C. Moore.
Am. Jour. Med. Sc., June, 1915.

BACTERIOLOGY AND PATHOLOGY

Acute Yellow Atrophy of the Liver in a Child of Four.—William H. Mayer.
Jour. Am. Med. Assn., July 24, 1915.

Adipose Tissue, Progressive Wasting Away of, in Certain Regions and Extra Growth at Others; Two Cases. (Lipodystrophia progressiva.)—E. Feer.
Jahrb. f. Kinderh., July, 1915.

Amaurotic Family Idiocy, New Symptoms in.—I. H. Coriat.
Boston Med. and Surg. Jour., July 1, 1915.

Cysts, Congenital, of Neck.—W. Senger.
Colorado Med., May, 1915.

Ductless Glands and Disturbances in the Skeleton and in Development in General.—A Josefson.
Svensk. Läkaresällsk. Handl., 1915, xli, No. 1.

Enlargement of the Skull with Web Fingers and Toes.—M. Bertolotti and G. B. Trotti.
Riforma méd., June 19, 1915.

Heated Milk, Common Organisms in; Their Relation to Its Reactions.—L. P. Shippen.
Bull. Johns Hopkins Hosp., July, 1915.

Heat Stasis, Clothing as Factor in Production of.—W. B. McClure and L. W. Sauer.
Am. Jour. Dis. Child., June, 1915.

Hemihypertrophy, Congenital, Case of.—J. M. Fortescue-Brickdale.
Lancet, London, July 3, 1915.

Hypertrophy of Thymus and Thymus Death; Report of Cases.—T. Le Boutillier.
Arch. Pediat., May, 1915.

Jaundice, Catarrhal, Three Cases of, in Infancy.—T. C. Hempelmann.
Am. Jour. Dis. Child., July, 1915.

Malformation, Congenital, of Both Hands and Forearms.—J. Metcalfe.
Arch. Radiol. and Electrotherap., June, 1915.

Nonepidemic Inflammation, Acute, of Sublingual Glands in Children; An Affection of Unknown Origin.—H. Neuhof.
Am. Jour. Dis. Child., August, 1915.

Otitic Pneumococcic Bacteremia.—Arthur S. Tenner.
Jour. Am. Med. Assn., July 17, 1915.

Rapid Growth of Children Predisposes to Morbidity.—C. Schimtz.
Norsk Mag. f. Laegevidensk., June, 1915.

Sarcomata, Ovarian, in Children; Report of Three Cases.—T. T. Higgins.
Brit. Jour. Child. Dis., June, 1915.

Teratoma in Lumbar Region of Child of 2.—B. Rosati.
Pediatria, June, 1915.

Thyroid Secretion in Normal and Pathologic Conditions.—N. E. Osokin.
Russk. Vrach, March 28, 1915.

HYGIENE

Child Hygiene Work, Future Lines of Progress in.—S. J. Baker.
New York Med. Jour., June 5, 1915.

Hygiene of the Child before Its Birth.—A. Pinard.
Ann. de gynec. et d'obst., May-June, 1915.

Infancy and Youth, State Efforts to Protect Life in.—L. A. De Vilbiss.
New York Med. Jour., July 24, 1915.

Pediatrics, Prophylaxis in.—H. R. Carroll.
Lancet-Clinic, June 26, 1915.

METABOLISM AND NUTRITION

Artificial Feeding, Research on the Nutrition and Metabolism of an Infant with Special Regard to.—E. Helleson.
Nord. med. Ark., xlviii, Internal Medicine, Nos. 3-4, 1915.

Breast Feeding; Some Functional Requirements of Gland and of Infant.—H. K. Waller.
Lancet, London, July 17, 1915.

Difficult Feeding, Homogenized Olive Oil and Fat-Free Milk Mixtures in Case of.—M. Ladd.
Arch. Pediat., June, 1915.

Energy Metabolism of Infant with Congenital Absence of Cerebral Hemispheres.—F. B. Talbot.
Arch. Pediat., June, 1915.

Human Beriberi, Experimental Treatment of, with Constituents of Rice Polishings.—R. R. Williams and N. M. Saleeby.
Philippine Jour. Sc., March, 1915.

Infant Feeding, Some Studies on Sugar in.—L. Porter and C. H. Dunn.
Am. Jour. Dis. Child., August, 1915.

Infantile Beriberi, Treatment of, with Extract of Tiqui-Tiqui (Rice Polishings).—J. Albert.
Philippine Jour. Sc., January, 1915.

Liver, Levulose Test of the Functional Capacity of the, in Infants and Children.—E. Schede.
Jahrb. f. Kinderh., July, 1915.

Milk, Some New Constituents of; Phosphatides.—T. B. Osborne and A. J. Wakeman.
Jour. Biol. Chem., July, 1915.

Prematurely Born, Nutrition and Growth of the.—L. Langstein.
Berl. klin. Wchnschr., June 14, 1915.

DISEASES OF THE NEW-BORN

Hypertrophy, Pyloric, in New-Born Infants.—F. L. Wachenheim.
Am. Jour. Dis. Child., August, 1915.

Jaundice of the Newly Born. (Icterus neonatorum.)—F. Bang.
Hospitalstidende, June 30, 1915.

Sclerema Neonatorum.—W. S. Paterson.
Quart. Jour. Med., July, 1915.

ACUTE INFECTIOUS DISEASES

Antitetanus Serum, By-Effects of.—F. Callomon.
Med. Klin., July 4, 1915.

Antitetanus Serum, Endoneural Injection of, and Drainage of the Nerve in Treatment of Tetanus.—F. Kempf.
Arch. f. klin. Chir., 1915, cvi, No. 4.

Brain Symptoms, Localizing (Hemiplegia and Hemispasm) As Early Events in Tuberculous Meningitis.—C. O. Hawthorne.
Brit. Jour. Child. Dis., August, 1915.

Cerebospinal Fever, Bacteriologic Examination of Contacts with, and Their Treatment.—H. C. Whiteside.
Jour. Roy. Naval Med. Service, July, 1915.

Cerebrospinal Meningitis, Epidemic; Report on Thirty-One Cases.—B. S. Robson and A. L. P. Gould.
Jour. Roy. Naval Med. Serv., July, 1915.

Cerebrospinal Meningitis, Serotherapy of.—P. Menetrier and A. Pascano.
Bull. de l'Acad. de méd., Paris, July 6, 1915.

Chickenpox, hemorrhagic, Case of.—D. G. Campbell.
Canad. Med. Assn. Jour., July, 1915.

Circumscribed Meningitis; Diagnosis and Treatment.—C. T. van Valkenburg.
Nederl. Tijdscher. v. Geneesk., June 12, 1915.

Contagious Diseases.—E. R. Kelley.
Boston Med. and Surg. Jour., July 29, 1915.

Diphtheria Bacilli, Alkali and Acid Production by.—V. S. Vesseloff.
Russk. Vrach., Feb. 28, 1915.

Diphtheroids, Studies in. Nature and Clinical Importance of Pseudodiphtheria Bacilli.—H. Fox.
Jour. Med. Research, July, 1915.

Epidemic Cerebrospinal Meningitis, Bacteriologic Diagnosis of.—A. Moses.
Brazil-med., June 22, 1915.

Measles in Two Infants, Sixteen and Eighteen Days Old.—M. Winter.
Jahrb. f. Kinderh., June, 1915.

Meningitis, Epidemic.—P. Costantini.
Gazz. d. osp., June 13, 1915.

Meningitis, Serous, from Lying on the Sand in the Sun; Two Cases.—C. Römer.
Deutsch. med. Wchnschr., July 8, 1915.

Meningococcus Carriers.—F. Bezançon.
Ann. de med., April, 1915.

Mumps, Epidemic of, with Unusual Localizations.—E. Schalit.
Med. Klin., July 4, 1915.

Mumps, Protective Therapy for.—A. F. Hess.
Am. Jour. Dis. Child., August, 1915.

Pertussis.—W. W. Behlow.
California State Jour. Med., July, 1915.

Pertussis, Complement Fixation in.—M. Olmstead and P. Luttinger.
Arch. Int. Med., July, 1915.

Pseudodiphtheria Forms in Body, Source of. Experiments on Mutation.—H. Fox.
Jour. Med. Research, July, 1915.

Rabies Virus, Rapid Transformation of, from "Street" to "Fixed" Form.—A. Beham.
München. med. Wchnschr., June 22, 1915.

Scarlet Fever, Diphtheria and Social Position.—F. Reiche.
Berl. klin. Wchnschr., June 14, 1915.

Scarlet Fever, Fusiform Bacilli in.—V. N. Klimenko.
Russk. Vrach, Feb. 28, 1915.

Scarlet Fever, Serotherapy in 1,335 Cases.—L. W. Aksinoff.
Ruskk. Vrach, Jan. 31, 1915.

Schick Test, a Simple Outfit for the Distribution of Toxin for the.—Abraham Zingher.
Jour. Am. Med. Assn., July 24, 1915.

Sore Throat, Elmhurst Epidemic of, and Virulence of Streptococci Isolated from Milk.—E. C. Rosenow and V. H. Moon.
Jour. Infect. Dis., July, 1915.

Tetanus, Modern Treatment of—K. Schroeder.
Hospitalstidende, July 7, 1915.

Tetanus, Research on.—L. Aschoff and H. E. Robertson.
Med. Klin., July 4, 1915.

Vaccination Pustule, Healed, Flares up Again Four Months Later During Diphtheria.—Eggebrecht.
München. med. Wchnschr., July 6, 1915.

Variola and Vaccinia, Relationship of.—P. M. Ashburn, E. B. Vedder and E. R. Gentry.
Mil. Surgeon, July, 1915.

Whooping Cough, Paralysis from; Four Cases.—S. T. Sørensen.
Hospitalstidende, July 14, 1915.

Whooping Cough, Pathologic Anatomy and Symptomatology of.—M. V. Shiperovich.
Russk. Vrach., Jan. 10, 1915.

Whooping-Cough, The Bordet-Gengou Bacillus Probably Responsible for.—I. Jacobsen and A. H. Meyer.
Hospitalstidende, June 23, 1915.

Whooping Cough, Treatment of.—A. Czerney.
Jahrb. f. Kinderh., June, 1915.

TUBERCULOSIS AND SYPHILIS

Heliotherapy at Home.—E. Kisch.
Arch. f. klin. Chir., 1915, cvi, No. 4.

Immunity, Inheritance of, to Tuberculosis.—C. Sabourin.
Presse méd., June 17, 1915.

Laryngitis, Tuberculous, in Child of 2.—E. Germonig.
Wien. klin. Wchnschr., June 17, 1915.

Pulmonary Tuberculosis, Early Diagnosis of.—R. H. Babcock.
Illinois Med. Jour., June, 1915.

Tuberculin in Diagnosis and Treatment.—M. Maxey.
Illinois Med. Jour., June, 1915.

Tuberculin, Hypersusceptibility to, and the Reverse Condition Realized under Tuberculin Treatment.—G. Bessau.
Jahrb. f. Kinderh., June, 1915.

Tuberculin Treatment of Children; Forty-Five Cases.—H. Koch.
München. med. Wchnschr., July 6, 1915.

Tuberculoma of Pons Varolii; Pulmonary Tuberculosis in Boy Aged Three and One-Half Years.—L. Guthrie.
Brit. Jour. Child. Dis., August, 1915.

Tuberculosis in Children.—W. W. Riha.
Med. Rec., New York, Aug. 7, 1915.

Tuberculosis and Housing.—A. M. Williamson.
Brit. Jour. Tuberc., July, 1915.

Tuberculosis, Hygienic Treatment of.—J. D. Dunlop.
Michigan State Med. Soc. Jour., July, 1915.

Tuberculosis, Pulmonary, Early Diagnosis of, from Standpoint of General Practitioners.—V. C. Vaughan, Jr.
Michigan State Med. Soc. Jour., July, 1915.

Tuberculosis, Sources and Modes of Infection with, Especially in Childhood.—G. Hedren.
Hygiea, lxxvii, No. 10, 1915.

Tuberculous, What Constitutes Proper Carbohydrate and Protein Diet in Treatment of.—J. Ritter.
Illinois Med. Jour., June, 1915.

Why Tuberculosis in Childhood Is Important.—H. M. Rich.
Michigan State Med. Soc. Jour., July, 1915.

GASTRO-INTESTINAL SYSTEM

Acidity Curves in Stomachs and Duodenums of Adults and Infants.—J. F. McClendon.
Am. Jour. Physiol., August 1, 1915.

Anal Stenosis in Boy of 7 Simulating Hirschsprung's Disease.—O. Sachs.
Jahrb. f. Kinderh., June, 1915.

Chronic Constipation, Operative Treatment of.—F. Rost.
Mitt. a. d. Grenzgeb. d. Med. u. Chir., 1915, xxviii, No. 4.

Foreign Bodies in the Esophagus, Simple Method for Extracting.—E. Ferreyra.
Semana méd., June 10, 1915.

Hernia of Stomach Through Diaphragm in Child Aged Nine Years.—W. J. S. Bythell.
Brit. Jour. Child. Dis., August, 1915.

Infectious Diarrhea, Relation of Gas Bacillus to, and Other Digestive Disturbances in Childhood.—P. H. Sylvester and F. H. Hibben.
Arch. Pediat., June, 1915.

Intussusception, Acute, in Infants.—F. V. Hussey.
Providence Med. Jour., July, 1915.

Pyloric Stenosis and Pyloric Spasm; Report of Three Cases.—C. H. Dunn and W. W. Howell.
Arch. Pediat., June, 1915.

Safety Pin in Esophagus of Young Child.—G. S. Otrich.
Jour. Am. Med. Assn., July 31, 1915.

RESPIRATORY SYSTEM

Asthma, Action of Hypophysis Extract on; Etiology of Asthma.—E. Riese.
Berl. klin. Wchnschr., July 19, 1915.

Tracheal and Bronchial Lesions, Comparative Pathology of, Produced in Man by B. Pertussis (Whooping Cough) and Those Produced in Dogs by B. Bronchisepticus (Canine Distemper).—L. J. Rhea.
Jour. Med. Research, July, 1915.

Trachea, Rupture of, in Boy.—C. Hörhammer.
München. med. Wchnschr., July 6, 1915.

BLOOD AND CIRCULATORY SYSTEM

Functional and Organic Cardiac Disease, Differentiation Between, in Children.—M. H. Bass.
New York Med. Jour., July 24, 1915.

Heart Disease in Childhood.—H. E. Tuley.
Am. Jour. Obst., July, 1915.

NERVOUS SYSTEM

Dementia Precox and the Internal Secretions.—W. M. Van der Scheer.
Nederl. Tijdschr. v. Geneesk., June 19, 1915.

Epilepsy in Young Adults and Adolescents, with Reference to New Treatment Based on Pathogenesis.—T. A. Williams.
Washington Med. Ann., May, 1915.

Infantile Paralysis, Tendon Transplantation Following.—C. G. McEachern.
Colorado Med., July, 1915.

Mental Defectives, What Tests in Childhood are Best Calculated to Throw Light on Capacities of, for Future Work?—W. A. Potts.
Lancet, London, July 17, 1915.

Neuropathic Child.—E. Stier.
Deutsch. med. Wchnschr., July 1, 1915.

Pachymeningitis, Hypertrophic Cervical.—S. Rizzardo.
Riforma med., July 10, 1915.

Paresis, Juvenile, Case of.—E. F. Leonard.
Illinois Med. Jour., June, 1915.

Rumination in Infants.—Wanietschek.
Jahrb. f. Kinderh., July, 1915.

GENITO-URINARY SYSTEM

Infections, Focal, Involvement of the Urinary Tract as a Result of, in Children.—Clifford G. Grulee and F. W. Gaarde.
Jour. Am. Med. Assn., July 24, 1915.

Urine, Influence of the Food, Especially of Carbohydrates, on the Secretion of, in Infants.—A. Niemann.
Jahrb. f. Kinderh., July, 1915.

Vulvovaginitis, Gonococcal, the Diagnosis and Treatment of, in Infants and Young Children.—Charles C. Norris.
Jour. Am. Med. Assn., July 24, 1915.

EYE, EAR, NOSE AND THROAT

Adenoid Operations, Unsuccessful.—W. Brady.
New York Med. Jour., July 17, 1915.

Parapharyngeal Abscess as Distinguished from Retropharyngeal and Peritonsillar Abscesses.—H. Heiman.
Am. Jour. Dis. Child., August, 1915.

Scrofulous Children, Photophobia in.—P. Silfverskiold.
Hygiea, Stockholm, 1915, lxxvii.

Tonsil and Adenoids, Partial Paralysis of Soft Palate Following Removal of.—D. Roy.
Laryngoscope, June, 1915.

SURGERY AND ORTHOPEDICS

Clubfoot, Congenital, the Prognosis of, and Its Relation to Nonoperative Treatment.—Eben W. Fiske.
Jour. Am. Med. Assn., July 31, 1915.

Congenital Scoliosis, Case of.—P. Werner.
Arch. f. Gynäk., 1915, civ, 2.

Deformity, Congenital, of the Fingers, and Pathogenesis.—C. Otto.
Hospitalstidende, July 21, 1915.

MISCELLANEOUS

Cerebrospinal Fluid in Diagnosis and Treatment.—W. H. Watters.
Boston Med. and Surg. Jour., July 22, 1915.

Children Born from Rape, the State Should Care for.—A. Herrgott.
Ann. de gynec. et d'obst., May-June, 1915.

Children's Diseases, Work on.—H. Thursfield.
Practitioner, London, June, 1915.

Craniometry in Diseases of Children.—G. Hardy Clark.
Jour. Am. Med. Assn., July 31, 1915.

Extraction of Coin from Child's Esophagus.—F. B. Stephenson.
Colorado Med., May, 1915.

Hereditary, Research on the Laws of. II.—W. Wangerin.
Med. Klin., July 11, 1915.

Illegitimate Baby, Care of.—A. D. Fordyce.
Brit. Med. Jour., July 31, 1915.

Infant Death Rate, Measures to Reduce.—L. Langstein. Commenced in No. 20.
Berl. klin. Wchnschr., May 24, 1915.

Infant Death Rate, Reduction of.—Behr-Pinnow and P. Rissmann.
Deutsch. med. Wchnschr., June 3, 1915.

Infant Mortality.—J. L. Morse.
Boston Med. and Surg. Jour., July 29, 1915.

Infant Mortality, Clean Milk as Factor in Reduction of.—A. Friedlander.
Lancet-Clinic, July 10, 1915.

Infant Mortality During the Heated Term.—H. Kleinschmidt.
Med. Klin., July 11, 1915.

Infant Mortality from Standpoint of State.—W. H. Coon.
Am. Jour. Pub. Health, July, 1915.

Infants, One Hundred, Clinical and Pathologic Study of.—R. M. Smith and S. Cobb.
Arch. Pediat., June, 1915.

Intelligence Examination and Evaluation, and a New Intelligence Examination Sheet.—J. Victor Haberman.
Jour. Am. Med. Assn., July 31, 1915.

Köhler's Disease of the Foot in Children.—E. Meulengracht.
Hospitalstidende, May 15, 1915.

Pediatric Center, Boston as.—J. L. Morse.
Arch. Pediat., June, 1915.

Pellagra in Childhood; Report of Case.—F. C. Knowles.
Am. Jour. Med. Sc., June, 1915.

Physician and Better Baby.—M. G. Cartwright.
New Mexico Med. Jour., May, 1915.

Raising Prematurely Born Infants in the Home.—J. Cassel.
Berl. klin. Wchnschr., June 21, 1915.

Sagittal Sinus in Infants as Site for Intravenous Injection.—L. Tobler.
Monatschr. f. Kinderh., 1915, xiii, No. 8.

Vital Statistics Law, Present, Undesirable Provisions in, and Suggestions for Their Correction.—E. R. Park.
Georgia Med. Assn. Jour., June, 1915.